SCIENTIFIC AMERICAN

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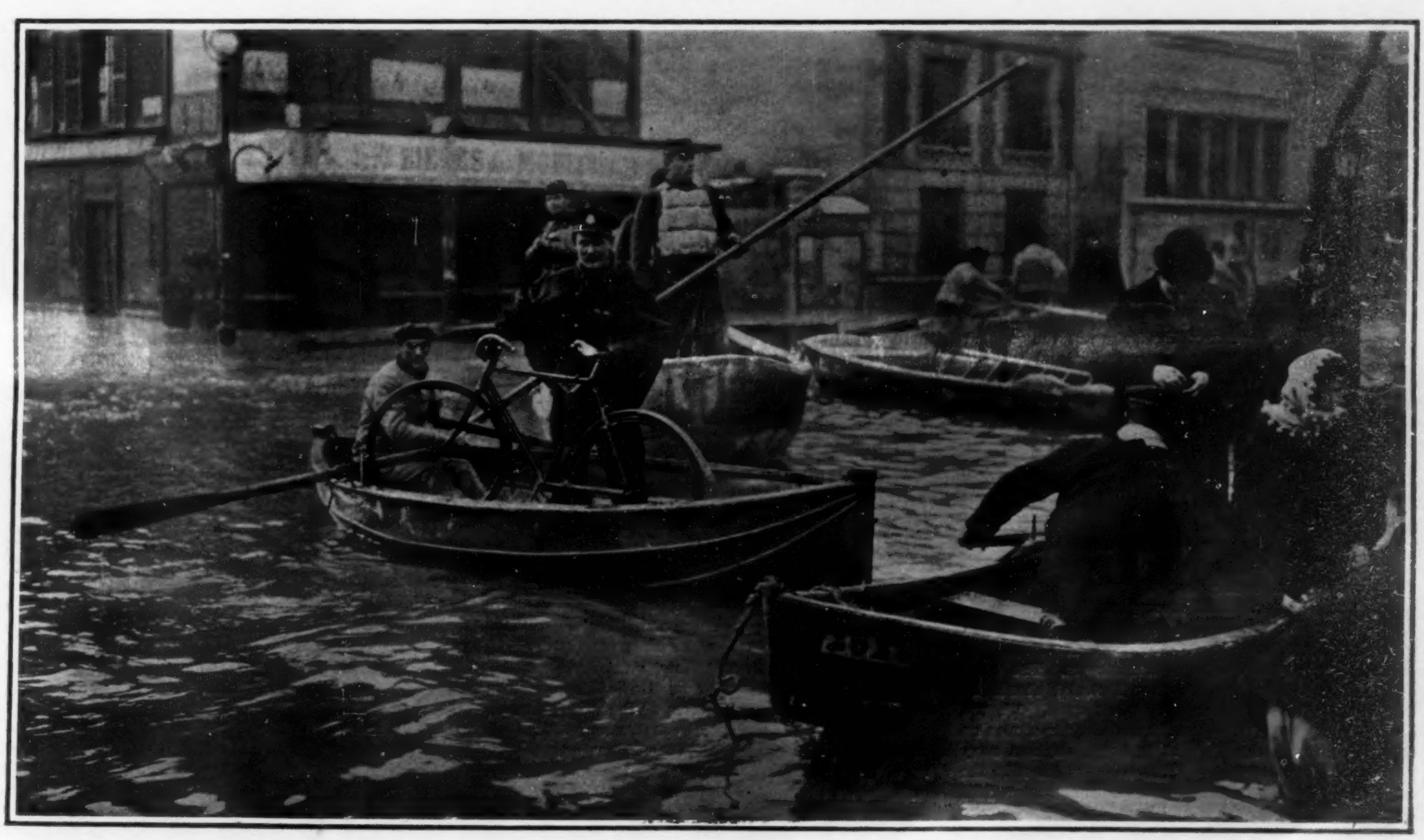
The Rue Surcouf was converted into a Venetian canal.



Soldiers and sailors assisting in relief work.

THE GREAT FLOOD OF PARIS.—[See page 164.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, FEBRUARY 19th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SECRETARY MEYER'S PLAN FOR THE REORGANIZATION OF THE NAVY.

THAT one of the first acts of Mr. Meyer on assuming the extremely difficult and responsible position of Secretary of the Navy, would be to make a thorough investigation of conditions, with a view to placing that very complicated department upon a more practicable working basis, was inevitable; as everyone must have foreseen who is familiar with the excellent work of reorganization which he achieved while holding the position of Postmaster-General.

The changes introduced by Mr. Meyer are necessarily supplemental to the work of his predecessor, Mr. Newberry, who had formulated and put into effect a system of consolidation, which, in the brief period of its operation, had shown excellent results. Mr. Meyer has assured us that the changes which he has instituted in the Newberry plan have been made not for the purpose of reversing but rather of amplifying the work of consolidation inaugurated by his predecessor. The essential changes involved in Mr. Meyer's plan are summarized under the following heads:

(1) The provision of four responsible advisers (of the Secretary) on subjects within the groups into which duties of the Department logically fall.

(2) The grouping of the Bureaus into two divisions of material and personnel, according to the nature of their duties.

(3) The establishment of a Division of Operations of the Fleet.

(4) The establishment of a comprehensive inspection system of a permanent organization, whose officers shall be periodically changed, who will come mainly from the active fleet and be conversant with the latest ships, and the modern methods of drill and organization.

(5) The establishment of a modern and efficient cost-keeping system in the Navy Department and at navy yards.

(6) The separation of navy-yard work into the two natural divisions of hull and machinery.

(7) He intends to require that commandants and captains of yards for navy yards shall be selected for their knowledge and experience, and that their tenure of office shall be long enough to insure continuous administrative policy.

The SCIENTIFIC AMERICAN has before it the printed record of the hearing of the Secretary and various Bureau chiefs before the House Naval Committee appointed to consider the proposed reorganization; and, after giving the same a most careful reading, we have come to the conclusion that, with one very serious exception, the measures proposed by Secretary Meyer are well adapted to promote that consolidation which Mr. Newberry began, and which the present Secretary is endeavoring to place upon a lasting, workable basis. The appointment of four aides, independent of the Bureaus, whose duties will be to inform and advise the Secretary on matters coming under the four general heads, is an excellent arrangement, the need for which had been keenly felt by previous secretaries. The Aides for Operations of the Fleet, for Personnel, and for Inspections are to be line officers. The question as to whether the Aide for Material should be chosen from the line or staff is left open. We are decidedly of the opinion that in seeking for advice on the question of material, that is, ships, engines, navy yards, etc., the Secretary should have as his aide the Chief, or some high ranking, Naval Constructor, who by training and experience is best qualified to advise upon these subjects. A proportion of three line officers to one staff officer among the aides would give a fair representation of both branches of the service, and would put the Secretary adequately in touch with the whole range of active work in his Department.

The feature of Secretary Meyer's plan which we consider to be open to very grave question is the proposal to separate the navy-yard work into two divisions of hull and machinery, with a separate and independent manager for each; for the change involves the defeat of one important object of the Newberry plan as affecting the navy yards, namely, the securing of efficiency, and the avoidance of confusion and delay, by placing the whole of the work affecting the construction of the ship in charge of the officers of a single corps, with a member of that corps as general works manager of the yard. Mr. Meyer recognizes that a navy yard is a military establishment and must be under military government; but this condition was met under the Newberry plan by placing at the head of the yard a commandant who is always a line officer of high rank. Under him came the manager, a naval constructor, whose executive powers were recognized as covering, not the military, but the industrial side of the work. In view of this distinction, we fail to see how the management of the yard as to its non-military and purely industrial features by a staff officer of the naval construction corps is, in any possible sense, a violation of that law of Congress, according to which a staff officer cannot exercise military command over any other than members of his own corps. Under the former or Newberry plan, line (sea-going) officers of the Engineering Corps, who were temporarily assigned to the steam engineering department at the navy yard, were subject to the naval constructor manager, purely in the industrial and not in the military sense.

If it is advisable for economy and efficiency, and the consensus of evidence is overwhelming on this point, that the navy yards should be under a single industrial management, and that this management should rest in the naval construction corps; and if under such an arrangement, any legal question is involved as to the right of the constructor-manager to exercise non-military authority over engineer officers of the line, who may be temporarily assigned to duty at the yard, then the sooner the law is modified the better for the interests of the navy, and of the American people as a whole.

If it be asked why both hull and machinery should be placed under the control of a single head, and that head the naval constructor, we reply that the hull and the machinery are merely subdivisions of one organic whole, and that the two are so greatly interdependent as to make it necessary that their design, construction, and subsequent repair be under the management of a single corps, who are qualified for the work by training, knowledge and practical experience. Now, we venture the statement, without any fear of successful contradiction, that the one body of men who combine the necessary knowledge of naval architecture, and steam and electrical engineering, to qualify them for the oversight of the construction and repair both of the hull and the machinery, is the corps of naval constructors. Unfortunately, much of the evidence which has been given before the committee has been directed to proving that the naval constructor is ignorant of steam and electrical engineering, and therefore not qualified to take charge of the shops devoted to these branches at the navy yards. That nothing is further from the truth is shown by the following consideration of their training and experience:

In the first place, the naval constructors are the pick of the Naval Academy graduates. They are selected from the highest numbers in their class, and, as a rule, have been taken from the first two or three. In making the selection, in addition to their academic standing, careful consideration is made of their general aptitude for the service as shown during their three or four years at sea; of their general officer-like qualities; and of their aptitude for the handling of men, and for general administration. The principle of selection is the same as is followed in the case of that other highly specialized and most efficient body of professional men, the corps of engineers of the army. After their education as line officers at sea, the constructors are given at the famous Massachusetts Institute of Technology a post-graduate course in naval construction, which is the most thorough of any in the world.

Furthermore (and we cannot too strongly insist that the impression that the naval constructor is not a qualified steam engineer is absolutely erroneous) the course at the Massachusetts Institute of Technology involves also thorough instruction in steam and electrical engineering, during which the prospective constructors are given a course of practical training in the machine shops and laboratories of the institution.

The life work of the naval constructor will be done on shore and mainly at the various navy yards; and by virtue of his long residence at these yards, or as inspector at the various private shipbuilding yards, he gathers an ever-increasing and immensely valuable knowledge of the operation of these great industrial plants. Future promotion and distinction for him lie along these lines. There is every incentive for him to become thoroughly proficient.

With the line officer, however, into whose hands Mr. Meyer's plan would commit the construction of all electrical and steam machinery, and the management of the large and elaborate plants at the navy yards where this work is done, the case is entirely different. After his four years' course at Annapolis, the prospective naval engineer goes to sea with the expectation of spending practically all of his time afloat; and, naturally, his sympathies, interests, and above all his ambitions, will be connected with sea duty. An assignment for service ashore is merely a break in the routine of his chosen life work. If the line officer be an engineer officer, he will enlarge at sea his knowledge of the care and operation of a ship's machinery; but since by far the greater part of his time is spent afloat, his opportunities for becoming acquainted with the complicated and difficult work of managing such large industrial concerns as the steam machinery shops of the navy yards are, in the nature of things, very limited. His work is to run, not to build, the engines; just as it is the work of the captain of the ship to run and not to build the hull.

Even when the line officer is ashore, his interests and future aims are still upon the sea; and, as a rule, he is only too glad when the next assignment for sea duty comes. Proof of this is found in the fact that during the past six years there have been at our seven leading naval yards, no less than 29 commandants and 41 captains of the yard. Evidently, the sea-going officer cannot too quickly get back to his natural sphere of service.

If there were available at the present time a corps of engineering officers who, like the naval constructors, had been specially trained for shore duty in the management of the machinery shops, etc., at the navy yards, we would have more hope of the success of this particular part of Mr. Meyer's plan; but outside of a few of the older engineers, trained under the system which obtained before amalgamation, no such body of men is available. Furthermore, it is our conviction that, were such a body existent, it would still make for economy and efficiency, if both hull and machinery were placed under the single management of a naval constructor.

That part of the Newberry plan which affected the navy yards was giving very promising results at the time Mr. Meyer took office. We have little doubt that his determination to separate hull and machinery was governed largely by certain alleged instances of incapacity of the naval constructors in their management of the machine shops, which were supplied to the Secretary, most of them over the signature of the Engineer in Chief. The testimony before the House Naval Committee now before us, however, shows that a subsequent examination of these reported cases has elicited from the commandants of the various yards (all of them line officers) a complete disproval of the charges as made—a very gratifying vindication of the work of the naval constructors in this particular regard. We cannot but feel that with this later evidence before him, the Secretary will be disposed to reconsider that part of his otherwise excellent reforms, which proposes to separate hull and machinery, and that he will allow the Newberry plan of a single management sufficient time to further demonstrate the economy and all-round efficiency of which it gave, in the few months of its operation, such great promise.

ELECTROLYTIC REMOVAL OF GREASE.

AN electrolytic method of removing grease from objects has been introduced in Germany. Grease can be rapidly removed from metallic objects by employing it as a cathode in a hot solution of potash or soda lye. It was supposed that the alkali metals set free at the cathode transformed the fatty matter into soap, but Barth has now shown that substances which cannot be saponified, such as machine oil, paraffine oil and paraffine, are removed very quickly by the current, and he explains this fact by mechanical action caused by bubbles of hydrogen which come off at the cathode. This action is produced only when the fatty matter is liquid. If the temperature of the bath is too low so that the grease is consistent, the removal is very slow and is incomplete. He operates with a moderately concentrated solution of carbonate of potash heated between 85 and 100 deg. C. As the anode he uses sheet iron or carbon pieces. When a piece of sheet iron covered with oil or paraffine is dipped into this bath it remains covered with oil ten minutes after immersion when the current does not flow, but upon sending the current all traces of oil disappear in a few minutes.

To permit two steamers to pass from the Wisconsin River to the Mississippi River, near Prairie du Chien, Wis., a railway bridge on the Chicago, Burlington, and Quincy Railway was raised by breakdown cranes a few weeks ago. There is no navigation on the Wisconsin River, but the two steamers were sent down to enter service on another route. The railway crosses the river near its mouth, and a 65-foot span was raised about 6 feet to clear the steamers' funnels.

ENGINEERING.

George W. Melville, Engineer in Chief of the United States Navy, states that there is every reason to believe that two ships of the navy will be fitted with the turbine reduction gear which we illustrated on the front page of our last issue. It is proposed to re-engine the "Baltimore" with turbines of 12,000 horse-power, and equip one of the new colliers with turbines of 6,000 horse-power, both employing this reduction gear.

The number of persons killed in train accidents during the months of July, August, and September, 1909, as shown in reports made by the railroad companies to the Interstate Commerce Commission, was 193, and of injured, 3,752. Accidents of other kinds, including those sustained by employees while at work and by passengers in getting on or off the cars, etc., bring the total number of casualties up to 20,093 (852 killed and 19,241 injured).

The Shoshone dam in Wyoming, which forms the leading feature of one of the projects of the Reclamation Service, has recently been completed. It is built of concrete, and measures 328.4 feet from foundation to the crest. It is 175 feet long at the top and 85 feet long at the bottom, where its thickness is 108 feet. The reservoir back of the dam, which has a capacity of 456,000 acre feet, will serve to irrigate 130,000 acres of land, situated about 75 miles east of the Yellowstone National Park.

The grand total of canal excavation at Panama for the month of December was 2,811,681 cubic yards. This is 362,366 cubic yards more than the total for November, but 1,068,656 cubic yards less than the highest record, made in March, 1909. Of the grand total, 1,455,611 cubic yards was dry excavation, removed principally by steam shovels. The dredges removed 1,356,070 cubic yards, in addition to the amount pumped into Gatun dam by the suction dredges engaged on that work.

In recognition of the culmination of his life work in the discovery of the North Pole, the Senate has passed a bill making Commander Robert E. Peary a rear admiral on the retired list. This signal recognition of the explorer followed closely upon the recent gathering, presided over by the Governor of the State of New York, at which Peary received a gift of $10,000, which, by the way, he immediately contributed to the proposed American expedition for the discovery of the South Pole.

Major Mason M. Patrick of the United States army, speaking on the subject of the construction of an artificial island and additional fortifications near the entrance to Chesapeake Bay, drew attention to the fact that the two largest and fastest merchant vessels afloat to-day could each carry 10,000 men with all their munitions of war, and, if unopposed, could land them on our coast in less than one week; and he also stated that more than one foreign power possesses a fleet of swift transports which can carry at one time over 100,000 men.

Secretary Meyer has asked for a large appropriation for the enlargement of the government drydocks to suit the huge battleships now under construction. He also asks for the construction of a $2,000,000 drydock at Norfolk; for an additional $1,000,000 for increasing the new dock at the New York navy yard to a length of 700 feet; for an additional $1,500,000 for increasing the Puget Sound dock to a width of 110 feet; and for the enlargement of the width of the Pearl Harbor dock, Hawaii, to the same width, at an increased cost of $450,000.

The new terminal station of the Pennsylvania Railroad Company at 33rd Street and Seventh Avenue, Manhattan, is so far advanced that it will be practically completed by the end of next month. The first service to be put in operation will consist of multiple-unit, standard size, electric trains running to Jamaica, Long Island, over a four-track road, which will soon be increased by the addition of two more tracks. This will be followed by the opening of the through express service to the West, which will be operated by the 4,000-horse-power electric locomotives illustrated in our issue of December 18th, 1909.

Were Jules Verne with us to-day, he would be greatly interested in two instances of rapid travel recorded during the past week. A traveler from London to San Francisco won a wager by covering the distance in two hours and thirty-five minutes less than ten days; the trip being made by the "Mauretania" to New York, the 20th Century Limited to Chicago, and the Overland Limited to San Francisco. A passenger from Lima, Peru, in making a hurried trip in response to a call to London, left Lima the same day by steamer to Panama; crossed by the Panama Railroad; made close connections with a steamer for New York; and caught the "Mauretania" for England. If the ship makes an average passage, the whole trip will have been covered in 19 days.

AERONAUTICS.

The first exclusively aeronautic show to be held in America is open at present in Mechanics' Building at Boston. A score of full-sized representative aeroplanes of all types, together with a large number of models, are on view. Several competitions for models will be held, and some of the gliders and motor-driven aeroplanes may be tried out upon the ice of the lake in Franklin Field. This exhibition will give one a good idea of the state of aeronautics in the United States to-day.

On the 10th instant Wilbur and Orville Wright were presented with the Langley medals of the Smithsonian Institution by Chief Justice Fuller at Washington. Dr. Alexander Graham Bell and Senator Henry Cabot Lodge made brief addresses. Wilbur Wright announced that as soon as he and his brother get their American company under way, they expect to devote their time to research work in aviation. The two gold medals were designed by J. C. Champlain, a member of the French Academy, the reverse being from the seal of the institution, which was designed by St. Gaudens.

Paulhan has expressed a willingness to fly in the vicinity of New York if Curtiss or some other interested person will have that injunction dissolved which now hangs over the heads of aviators using warpable planes or hinged wing tips. His brilliant success in California leads one to hope that his desire may be gratified in the interests of a sport of which the United States in general and the East in particular knows lamentably little. If Paulhan really gives an exhibition in these parts he will do much to stimulate New York's interest in aviation. The Hudson-Fulton flights were after all a fiasco, and yet they roused New York to an intense pitch of excitement. Paulhan ought to do better.

The first week of February the suit of the Wright brothers against Paulhan for an injunction restraining him from giving exhibitions in his Farman biplane was tried before Judge Hand in the United States Circuit Court in New York city. Judge Hand manifested great interest in the case, and his decision is awaited with interest. It is uncertain whether he will grant a preliminary injunction, as Judge Hazel did at Buffalo last December. In defending the attack of the Wrights upon the Bleriot monoplane, Mr. E. R. Newell asserted that Prof. S. S. Montgomery's patent, which antedates the Wright patent, covers the same system of plane warping as the Wrights themselves claim, and he further says that the machine as built to-day does not correspond with the patent. A full report of the Wright-Curtiss case and the text of Judge Hazel's decision appears in the current Supplement.

As soon as he had finished flying at Los Angeles, Charles K. Hamilton went to San Diego, where he made a number of daring flights with his Curtiss biplane. On January 23d, after starting from the vast plain near the Hotel Del Coronado, Hamilton twice flew out over the ocean so far that he disappeared from view for ten minutes. When he re-appeared he came from a different direction. In the first flight he covered about 10 miles, and in the second one 15. The wind was blowing at times as high as 20 miles an hour. After circling upward to a height of about 800 feet, Hamilton stopped his motor and made a wonderful long straight glide to earth. This is probably a record performance, certainly the longest glide ever made in America. A week later, at Bakersfield, Cal., he made two excellent flights under difficult conditions. Starting from a half-mile track, he flew about the town and out over the desert and adjoining oil fields, finally landing successfully at the starting point. His mastery of the biplane seemed complete.

Subsequent to the Los Angeles aviation meeting, M. Paulhan made excellent exhibition flights at San Francisco, Denver, and New Orleans. At San Francisco, on January 24th, he made several flights in a strong wind, the last and highest of which, of 12 minutes duration, was made after sunset. Two days later he rose to a height of 1,300 feet in a flight of 31 minutes' duration. On February 1st, at Denver, he was mobbed by a crowd of 30,000 people eager to see him fly. After three preliminary attempts, he finally left the ground and made two circuits of the course at Overland Park. The next day he made a 15-mile cross-country flight in a driving snow-storm. In starting, he ran his Farman biplane through snow three inches deep, and when he alighted, the planes and struts of the machine were in many places covered with snow, while Paulhan himself was suffering from the bitter cold. Previous to this long flight, he made a preliminary flight of 8 miles. On February 4th, after circling the Park successfully a dozen times, Paulhan twice was unsuccessful in starting in the distance at his disposal. The first time one of the wheels of his machine struck the fence and was knocked off, while the second time the machine crashed into the fence and was demolished. Paulhan was unhurt, but several spectators were injured.

SCIENCE.

The American Museum of Natural History in New York city has commissioned William Couper to model a statue of Commander Robert E. Peary for the Museum. The statue is to be life size and of marble.

In a bulletin issued by the United States Department of Agriculture Mr. Ned Dearborn writes on methods of destroying English sparrows. The evidence of the destructiveness of the sparrow is overwhelming, for which reason some means should be adopted to check the spread of the bird. Mr. Dearborn recommends the destruction of the nests from two to twelve days throughout the breeding season. Thus the number of English sparrows could be reduced without resorting to shot, poison, or traps.

The Smithsonian Institution has received a letter from ex-President Roosevelt, dated December 15th, 1909, from Nairobi, informing the secretary of that Institution that his expedition has finished its work in British East Africa. The collections made in that country aggregate 8,463 animals, which include mammals large and small, birds, reptiles, and batrachians, fresh-water and marine fish. Considering the fact that probably over 95 per cent of these animals find their duplicates in the natural history museums of this country and of Europe, ex-President Roosevelt seems to have been doing much unnecessary killing.

The Radium Institute of America has been incorporated. Its purposes are to study radium and radio-active substances, rays, and emanations in the interests of science and humanity, and to maintain a chemical laboratory, library, meeting room, and offices, and to acquire and hold patents and licenses to deal in radium and properties pertaining to radium. The headquarters of the institute will be located in New York. The twelve incorporators are: Dr. Robert Abby, Dr. Nicholas Murry Butler, Charles F. Chandler, Bergen Davis, William J. Gies, William Hallock, Ellwood Hendirck, Hugo Lieber, Dr. Willy Meyer, George B. Pegram, Hugo Schweitzer, and Edgar F. Smith of the University of Pennsylvania.

An expedition to observe and photograph Halley's comet from the Hawaiian Islands is to be sent out by the Astronomical and Astrophysical Society of America. In view of the possible perturbations arising from the close approach of the comet to the earth on May 1st and to Venus on May 16th to 18th, meridian observations are especially desired during the period in which the comet is sufficiently bright for that purpose. The close approach of the comet to the earth will afford an unusual opportunity for a study of the physical condition of comets. The comet's close proximity to the sun at the time of maximum brilliancy imposes serious limitations upon the Society's programme. Widely extended co-operation will be required throughout the whole world if a continuous photographic record is to be even remotely realized.

The American Museum of Natural History has been presented with a life-size marble statue of Morris K. Jesup by J. Pierpont Morgan, Henry Fairfield Osborn, Cleveland H. Dodge, Charles Lanier, J. Hampden Robb, Joseph H. Choate, and others. At the unveiling of the statue addresses were delivered by Prof. Osborn (who succeeded Mr. Jesup as president of the Museum), Mayor Gaynor and Joseph H. Choate.

Commander Robert E. Peary has contributed $10,000 to a fund for the equipping of an American expedition to the South Pole. The check for the amount of his contribution had been handed to him by Gov. Hughes on behalf of the people of New York as a testimonial of appreciation of his achievement in finding the North Pole, and the Metropolitan Opera House was crowded with people who had come to take part in what the fostering Civic Forum called a "national testimonial" to the explorer.

There is a gaseous element, discovered in the atmosphere by Ramsay, which is remarkable for its chemical inertness, but though destitute of chemical properties it possesses a very curious physical property which was discovered by J. Norman Collie. When a sealed glass tube, containing mercury in an atmosphere of neon at low pressure, is shaken it becomes strongly luminous. Similar effects are obtained when other gases are substituted for neon, but the light emitted by neon in these conditions is especially bright. If the shaking is repeated at intervals during two or three hours, the intensity of the light diminishes for a time and thereafter remains constant. The original luminosity can be restored by passing an electric discharge through the tube. If one end of the tube is heated to 750 deg. F. while the other end is cooled by immersion in liquid air, and the tube is then allowed to return to the ordinary atmospheric temperature, the part which has been heated glows much more brightly than before. The luminosity is also greatly increased by substituting a tube of fused quartz for the glass tube. G. Claude is endeavoring to utilize this remarkable property of neon as a source of light, and claims to have constructed neon lamps of an efficiency equal to about 1 watt per candle-power.

DID GREAT BRITAIN HAVE THE FIRST "DREADNOUGHT"?

THE "ROYAL SOVEREIGN" OF 1862

BY PERCIVAL A. HISLAM

The Scientific American for November 20th, 1909, contained a description by Mr. William Boerum Wetmore of the U. S. S. "Roanoke," a converted steam frigate, which he claimed to have been the original prototype of the "Dreadnought." The date of the conversion of the "Roanoke" from the frigate into the three-turreted ironclad was 1863; but England, the birthplace of the twentieth century "Dreadnought," has a similar instance to the "Roanoke," but which dates from the previous year—1862.

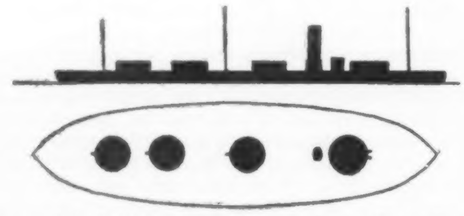
The "Royal Sovereign," as this ship was named, was built as a three-decked sailing ship of 3,144 tons and 120 guns, and in 1860 had been fitted with engines of 800 horse-power. The sides of the "Royal Sovereign" after conversion were composed of three feet of solid timber, strengthened internally with diagonal iron bands and clothed externally to some distance below the waterline with 5½-inch rolled armor plates. One-inch iron plating was laid upon the deck beams, and over the iron plating was laid the deck proper, consisting of 6-inch and 8-inch oak planking. From the sides of the ship the deck sloped upward to the outer circumference of the turrets, which thus appeared like circular forts on the apex of a glacis.

The following description is taken from a contemporary account in the London Times newspaper: "Stepping on the 'Royal Sovereign's' upper deck, we find that her light iron bulwarks, 3 feet 6 inches in depth, are thrown down outward on hinged stanchions. On the crest of the deck stand the four turrets and pilot house, funnel casing, hatchways, and ventilating shaft. The foremost turret, standing five feet above the deck, has its top covered by a grating, and is surrounded by a handrail, and thus affords a deck promenade for the officer of the watch or lookout man. The single-gun turrets are 4 feet 3 inches above the deck." . . .

It was claimed at the time that the method of mounting and working the guns in the "Royal Sovereign" was superior to anything which had then been applied in any American turret ship. In American designs the turret rested upon the upper deck, and was thus liable to easy disablement; but in the English vessel the base of the turret was on the lower deck, and the citadel was therefore much less likely to be disabled by a hit. The American method resulted in the turret being nine feet above the deck, while in the "Royal Sovereign" only five feet or four feet three inches, as the case might be, was exposed to the enemy's fire. Further, the latter ship's turrets could be worked by rack and pinion inside the turret, by the same method from the outside, and by handspikes worked like capstan bars, as well as by steam.

It will be seen that the "Royal Sovereign" had four turrets—one more than the "Roanoke"; but she had one gun less, for while the foremost contained two guns, the others had only one each. All the turrets were mounted on the center line of the ship, and the guns were muzzle loaders of 12½ tons, firing a 300-pound shot.

The original speed of the "Royal Sovereign" had been 12.25 knots, but after conversion this fell to 11, a difference which was fully accounted for by the increased immersion of three feet. Her freeboard remained at seven feet after conversion. The cost of the work was $699,900.



Converted British three-decker "Royal Sovereign" changed to an all-big-gun battleship in 1862.

WAS THIS THE FIRST "DREADNOUGHT"?

The "Royal Sovereign," besides having been, at any rate, one of the prototypes of the modern "Dreadnought," is interesting as having been the first vessel in which the turret principles of Capt. Cowper Coles were put into practice. The first vessel actually built in England embodying those principles was the "Captain," an ironclad of 4,272 tons, which capsized in the Bay of Biscay on September 6th, 1870.

According to contemporary accounts, the speed of the "Roanoke" was only 5 knots. This is inferior to the "Royal Sovereign's" speed by 6 knots. The latter vessel, again, had four turrets to the "Roanoke's" three; both ships had 5½ inches of side armor in a rolled plate, although up till then most American ships had been armored on the inferior laminated system; both ships were practically mastless, for the three poles of the "Royal Sovereign" reached only just above the top of the funnel. In freeboard there was little to choose between the two, while in the method of placing the turrets the British ship was decidedly superior.

Much, therefore, as we owe to America in the development of modern navies, and more especially, perhaps, in the introduction of steam navigation and in the correct placing of turrets in modern battleships, I think it must be admitted that Great Britain was the first to possess a prototype of the modern "Dreadnought."

I have been unable to procure a picture of the "Royal Sovereign" for reproduction, but the accompanying elevation and plan will convey an idea of the appearance of the ship.

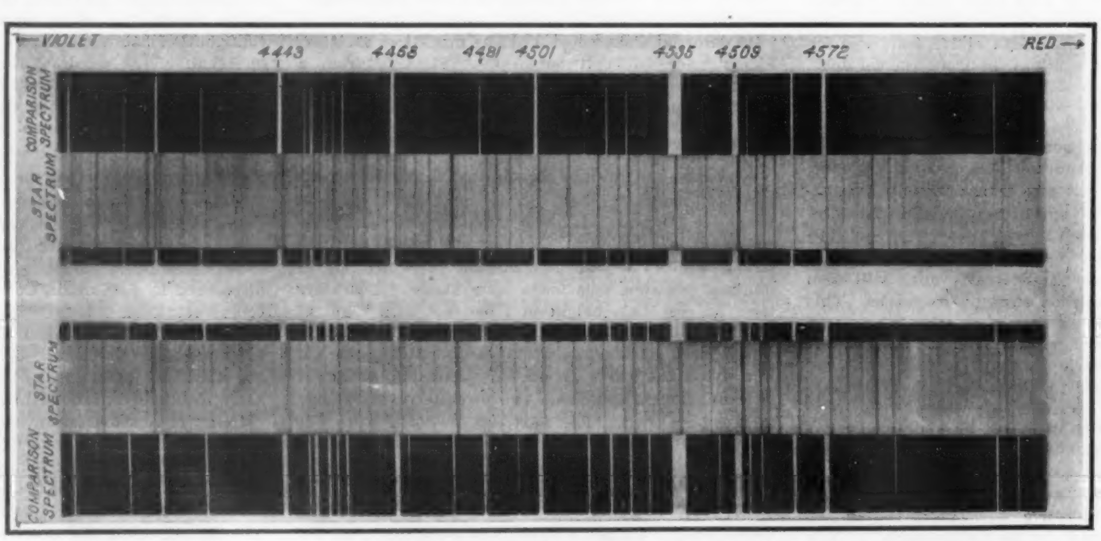
It may be mentioned that Russia launched in 1867 the "Admiral Lazareff," a three-turreted ironclad of 3,754 tons, very similar in general design to the "Roanoke." She carried in each turret two 15½-ton guns; but it was seen fit later to alter this to one 11-inch for each. In view of the diagonal (or echelon) arrangement adopted in the British "Dreadnought" cruisers of the "Invincible" type, it is interesting also to note that Italy led the way with this system of mounting with the "Duilio" (1876), Great Britain following with the "Inflexible" in 1881, and with four other ships a few years later. The only American examples of this system of mounting were seen in the "Maine" and "Texas," the first with two 10-inch and the second with one 12-inch gun in each turret.

The arrangement of the turrets in the British "Dreadnought" had a prototype in the French "Admiral Duperré," launched in 1879. This ship had two turrets on the center line and on the same level aft, and a turret on each beam just forward of the funnels. The guns had a freeboard of 27 feet 5 inches, giving them a great command of fire. Each turret contained one gun of 13.5 inches caliber; and if another center-line turret be added forward of the two beam turrets, it will be seen that the arrangement of the "Dreadnought" is almost exactly reproduced. It is strange how often we are confronted with the fact, in reading old books and other records, that there is "nothing new under the sun."

OTHER WORLDS IN SPACE

BY PROF. S. A. MITCHELL, COLUMBIA UNIVERSITY

If one should look at the heavens on any clear moonless evening, he would see them shining with countless orbs of light apparently millions in number. It is a fact that from our earliest education we have regarded the terms "numberless as the sands of the seashore," and "countless as the stars," synonymous with quantities almost infinite; but if by the stars we mean those that can be seen by the naked eye (and the expression originated thousands of years before the invention of the telescope), our ideas have been utterly at variance with the truth. The unaided eye cannot see millions of stars as is commonly supposed, nor yet hundreds of thousands, for at any one time we could count only two to three thousand separate stars, and in the whole heavens there are less than six thousand which can be seen without a telescope. A small glass, however, increases this number largely, and with greater and greater telescopes more and more stars are brought to our ken. It is estimated that the astronomer of to-day can see and photograph upward of a hundred million of stars. Each of these is a sun shining by its own light; the new astronomy tells us that thousands of these suns have systems around them possibly resembling our own solar system, and it is not outside the bounds of probability that many of the planets about these distant suns may be inhabited by people who live and move and think. Indeed, this earth of ours, of so much importance to us, is a most insignificant speck in the almost limitless universe.



PHOTOGRAPHS OF THE SPECTRUM OF μ ORIONIS, JANUARY 5th AND 8th, 1906.

The upper spectrum shows a velocity of 28 miles per second away from the earth, and the lower one of 43 miles per second in the same direction.

Astronomers by their meridian circles have been able to measure the exact positions of these distant so-called "fixed" stars, and have come to the conclusion that in spite of their names, there is none of them absolutely fixed in space, i. e., without motions. The movements of these heavenly bodies at the enormous distances we are from them are however very small, and the changes of position in the sky so slight from year to year that they could not be found without the most careful measurements. So from this point of view the stars are fixed, and the constellations appear the same now as they did to the Chaldean shepherds thousands of years ago. Still the motions are there none the less. The old astronomy was able to measure motions athwart the sky, at right angles to our line of vision; the new astronomy is able to supplement this by a knowledge of their movements toward us or away from us in the line of sight. The revelations of this new branch of astronomy are revolutionary in their importance, and of the greatest moment to our ideas of the universe as a whole.

The principles underlying the use of the modern spectroscope applied to the stars are given in Scientific American, December 25th, 1909. There is required for this purpose a powerful telescope, and a most accurate spectroscope attached, whose temperature must be kept absolutely uniform during the two or three hours that may be consumed while the photo-

(Continued on page 170.)

CONCRETE CONSTRUCTION ON THE PANAMA CANAL

HOW THE EIGHT MILLION CUBIC YARDS OF CONCRETE IS HANDLED

To the untrained eye the work which has hitherto been done on the construction of the Panama Canal necessarily appears more or less confused and chaotic. Although over one-half of the excavation has been completed, very little if any of the prism of the canal has been excavated to its finished dimensions, and the outline of the completed work is therefore irregular and ragged.

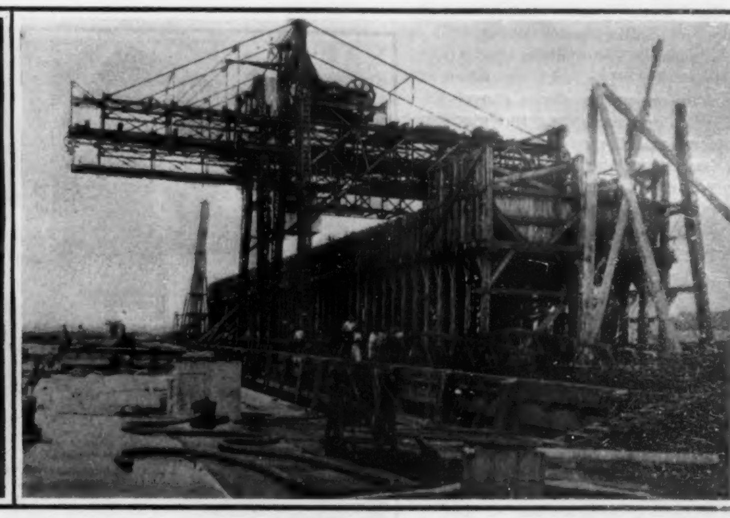
Some few months ago, however, the work of putting in the permanent concrete structures began, and from now on this great work will begin to take on definite shape and present visual evidence of its massive and permanent character.

The masonry works will not only be the largest of their kind ever built, the locks and spillways being on a scale of unprecedented proportions, but these works in the aggregate will probably represent the largest mass of masonry of any kind whatsoever hitherto placed in a single engineering work of magnitude. It is questionable whether an exception would have to be made even in the case of some of the famous masonry aqueducts built in ancient times; and the Pyramids or the Great Wall of China are not to be seriously reckoned in comparison with difficult hydraulic works of the character of those on the Panama Canal. In the accompanying series of photographs, which were recently taken on the Isthmus, one is able for the first time to gain some impression of the massive character of the concrete and reinforced-concrete structures the construction of which is now proceeding with gratifying rapidity.

The concrete work embraces six huge locks, three at Gatun on the Atlantic side of the Isthmus, one at Pedro Miguel and two at Miraflores on the Pacific side, and the great spillway in the center of the Gatun dam for carrying off the surplus waters. All of the locks will be 110 feet wide by 1,000 feet long, with a depth over the sills of 45 feet. The three locks at Gatun will form a continuous structure which, with the piers forming the approaches at each end, will have a total length of 3,800 feet, the whole work forming one huge monolithic mass of concrete. The Pedro Miguel lock with its piers will be 1,800 feet, and the two locks and piers at Miraflores will have a length of 2,800 feet. Into the construction of these locks will enter about 8,000,000 cubic yards of concrete, and of this 900,000 tons will consist of cement. The spillway through the Gatun dam has been cut through a low

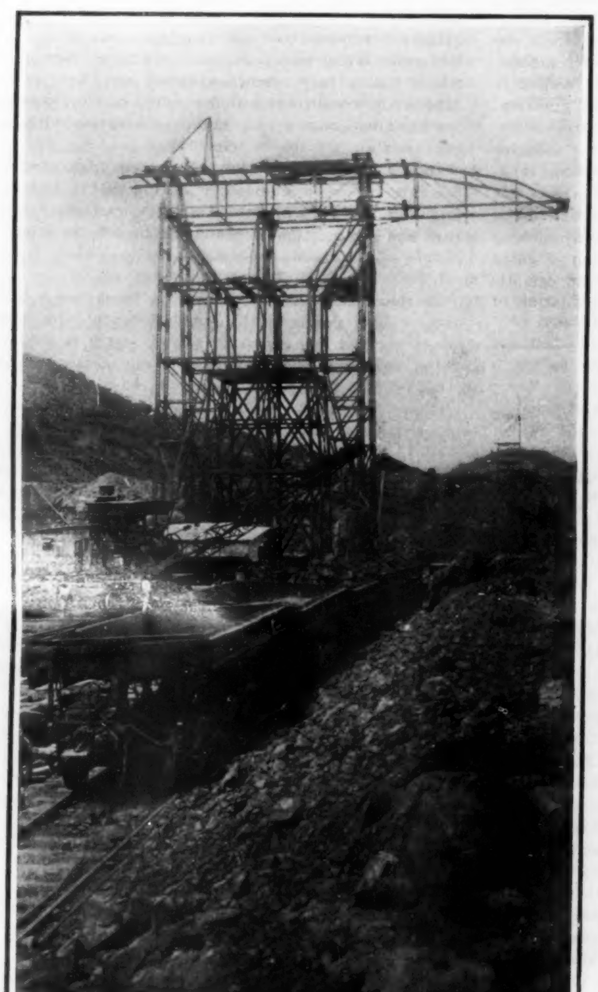
Note the wooden forms in which the walls are molded.

Building concrete side wall—Gatun Spillway.

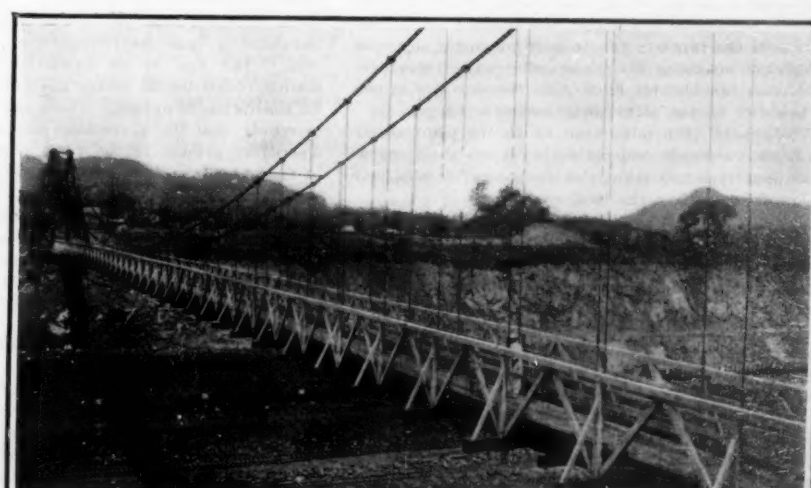


Millions of tons of sand are needed for the concrete.

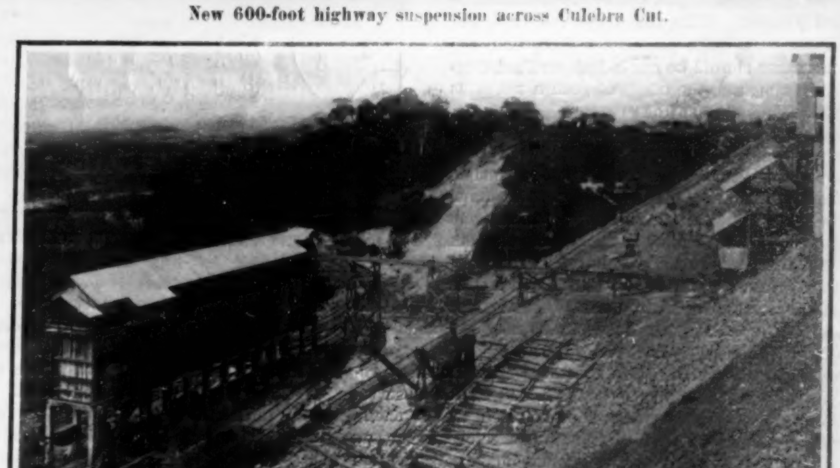
Sand cranes and pockets at Balboa.



Huge cantilever crane for placing concrete at Pedro Miguel locks.



New 600-foot highway suspension across Culebra Cut.



Stone for the concrete is brought from twenty miles east of the canal.

The stone crushers at Balboa.

CONCRETE CONSTRUCTION ON THE PANAMA CANAL.

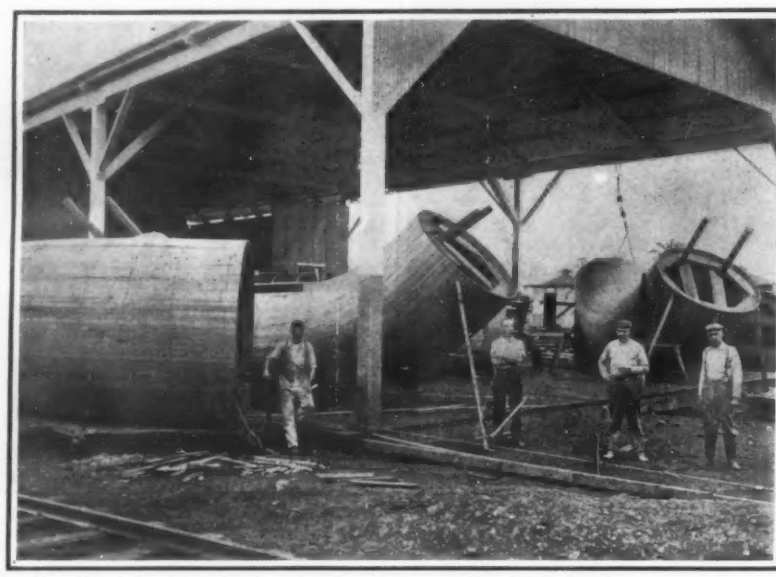
hill situated at about the center of the dam, and within the excavation thus formed is now being laid the deep concrete flooring, the massive retaining walls, and the piers between which will swing the gates for regulating the height of the water in that great artificial inland sea which will be formed by the dam.

It can readily be understood that the economical and expeditious laying of 8,000,000 cubic yards of concrete in structures of this magnitude called for a special plant of great size and capacity. At Gatun about 4,000,000 cubic yards of concrete will be employed. The crushed stone, the sand, and the cement for this concrete is handled in the following manner: The crushed stone comes from Porto Bello, a small hamlet about 20 miles east of Colon along the Atlantic coast. The rock is taken from the quarry by steam shovels, and sent by gravity to the giant crushers, and thence by gravity to the barges in the harbor. From this point it is carried to Cristobal, at the Atlantic entrance to the canal, and thence, *via* the old French channel, to the docks at Gatun. Here it is unloaded into storage bins by giant grab buckets, operated from cableways suspended between two sets of towers on either side of the channel.

The sand is brought from Nombre de Dios, about 40 miles along the coast from Colon. It is taken from the sand pits by clamshell buckets, loaded into steel barges, and taken to Gatun, where it is unloaded by a process similar to that of unloading the crushed rock. The cement is now being shipped from New York. At Colon the cement is transferred to barges and taken *via* the old French channel to Gatun and unloaded to the storage yards. The rock and sand storage piles have a capacity of about 300,000 cubic yards, while the cement yard accommodates about 100,000 barrels. From these storage buildings, the rock, sand, and cement are delivered through valves to charging cars running underneath. These cars, which are electrically operated, carry the materials to the concrete-mixing machines located nearer the locks' site and discharge it direct to the machines. After the concrete is mixed, it is dumped into buckets set on flat cars, and the cars are run to position under the wide cableways spanning the locks' site, and from these cableways the buckets filled with concrete are swung to position on the locks under construction.

The general principles upon which the plant at the locks on the Pacific side is designed are the same as those employed at Gatun; the mechanical details have been varied to meet the local conditions.

The latest report of the work, namely, that for December last, shows that during the month the total work of excavation amounted to 2,618,662 cubic yards, and that the total canal excavation of all kinds amounted to 2,811,681 cubic yards. The material placed in dams, mainly at the Gatun dam, amounted to 340,610 cubic yards, and during the month 57,265 cubic yards of concrete were built up in place.



The sluiceways, etc., for rapidly emptying and filling the locks are of unusual size.

WOODEN FORMS FOR GATUN LOCK CONDUITS.

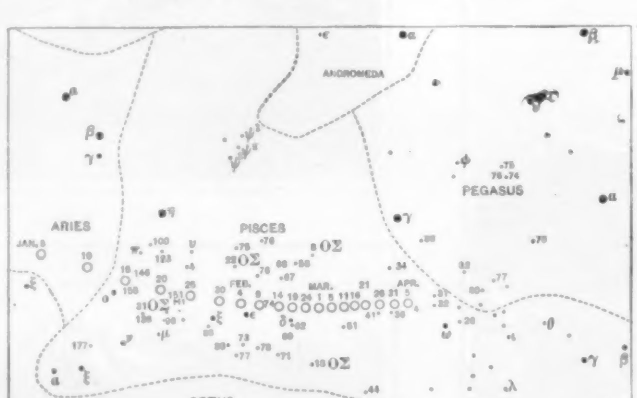
HALLEY'S COMET.

Some interesting measures of Halley's comet, made with the micrometer of the Yerkes 40-inch refractor, are published by Prof. Barnard in No. 605 of the Astronomical Journal. With this large telescope the comet was quite an easy object, and the measures should be good; but, as Prof. Barnard suggests, the edges of such a nebulous body are not easy to set on.

The measures extend up to November 30th, 1909, when the estimated magnitude was about 11.0, and the comet showed a condensation of some 7 inches diameter. The diameter of the whole object was 41 inches, and possibly an ill-defined nucleus was seen, but this feature was very doubtful. From September 17th to November 14th the measured diameters, reduced to miles, ranged from 16,400 to 9,200 miles, the mean being 12,800 miles, or about 1½ times the earth's diameter.

At the December, 1909, meeting of the Royal Astronomical Society, reported in No. 418 of the Observatory, the Astronomer Royal announced that a photograph secured with the Reynolds reflector at Helwan, on August 24th, shows the comet's image; its position agrees within 0.12s. in R.A. and 1.7 min. in declination with the position calculated from the Cowell-Crommelin orbit corrected by the Greenwich observations. Messrs. Keeling and Knox-Shaw are to be congratulated heartily upon securing the first known photograph of the comet. In No. 25 of the Gazette astronomique, Signor Pio Emanuelli discusses the probable encounter between the earth and the comet's tail in May next. At 10 A. M. (G.M.T.) on May 18th the comet will pass the descending node of its orbit, while the earth will pass the same point eighteen hours later. For an encounter between the tail and the earth to take place, it is shown to be necessary that the latter should be 22,100,000 kilometers (13,732,277 miles) long, and that its breadth should be such that it extends, from its axis earthward, 400,000 kilometers (2,485,550 miles).

The accompanying chart shows approximately the apparent path of the comet, according to Mr. Crommelin's ephemeris, up to April 5th.—Nature.



APPARENT PATH OF HALLEY'S COMET FROM JANUARY 5th TO APRIL 5th.

The Occluded Gases in Coal.

Prof. S. W. Parr and Mr. Perry Barker of the University of Illinois have made an elaborate study of occluded gases in coal, which is published in a bulletin recently issued by the university. As a result of their work it seems that two active processes are set up immediately upon the liberation of the coal from the vein. The first is an exudation of hydrocarbons, mainly consisting of marsh gas (CH_4); the second is an absorption of oxygen. There can be little question, moreover, that the alterations proceed simultaneously. There are present in the gases from all the samples of fresh drillings, notable quantities of methane, ranging from 18 per cent to 86 per cent of the various gas volumes. At the same time the oxygen present drops in a very positive manner, in some cases even reaching the vanishing point. That this transpiration of gases is interdependent and is of the nature of an osmotic exchange can hardly be affirmed as an explanation of the phenomenon. On the contrary, there seems to be evidence that the gases operate independently of each other.

In the case of samples of marsh gas the exudation of CH_4 seems to have spent itself in those samples held in laboratory containers for two years. In no case is there evidence of further liberation of this gas, even with thorough application of the vacuum. An evacuation of the gases from two-year-old samples shows no marsh gas present. The completion of this exudation would seem to be reached after two months, though it is well to note that by forcing, as with a vacuum, the two-months-old sample may be made to yield more methane, though in relatively small quantities. On the other hand, the avidity of the coal for oxygen seems to be pronounced at the very beginning of the exposure of the freshly-mined material; and while there are a number of cases where a certain agreement seems to exist between the in-going and the outgoing marsh gas, still there are more cases where the absorption of oxygen is pronounced without any evidence of marsh gas being present. In all cases the oxygen-nitrogen ratio shows a positive diminution of the oxygen from the normal ratio of approximately 1 to 4 with practically no evidence of marsh gas being present. It seems fair to conclude, for the present, that there is no necessary connection, at least of a strictly chemical nature, between the exudation of marsh gas and the absorption of oxygen.

Again, the liberation of CH_4, while very active in the first few days after removal of the coal from the ground, diminishes in amount quite rapidly till, after the second month, there is very little of this gas in evidence. The activity of the coal for oxygen, on the contrary, seems to be of longer duration. Samples collected June 1st, 1906, were tested in May and June, 1908. There is marked absorption of oxygen in the sample after two days' exposure in the flask to normal air, while in a second, with five days' exposure, a still further reduction in the oxygen ratio without accompanying evidence, also, it should be noted, of marsh gas, was obtained. A marked avidity for oxygen was shown after two years from the time of collecting.

These facts have a direct bearing on the topic of deterioration as substantially defining the limit as to time of that form of alteration. While varying somewhat in different coals, the loss of hydrocarbons for the most part is practically complete at the end of two months. These facts have a bearing also upon the matter of weathering, and indirectly upon the matter of spontaneous combustion. The absorption of oxygen is undoubtedly closely associated with both of these phenomena. The studies upon the weathering processes coincide with these studies in gases, namely, that in all probability this low type of oxidation extends over an indefinite length of time. Moreover, while under normal conditions there is effected but a very slight oxidation and loss of fuel values, the conditions are favorable, as, for example, for bringing about a very rapid combination with oxygen upon an increase of temperature.

How far this absorption of oxygen is a chemical reaction, or low combustion resulting in CO_2 and H_2O, and how far an absorption into the molecular structure and composition of coal must be left for study.

Dying Pearls.

In the Museum of the Louvre in Paris lies a collar of pearls at the point of death! Its deathbed is a plaque of velvet; and it is the large collar that was part of the personal estate of Thiers and once belonged to his wife. It is simply set and has no artistic value; its material value, however, is estimated at $60,000. It consists of 145 pearls in three rows, the total weight of which is 2,097 grains, the three largest pearls of the collar weighing 36, 39, and 51 grains respectively. This collar must "die"; every day it loses another degree of its luster, and in the course of the present decade it will become as dingy as a much-worn wreath of roses.

Why? Because pearls keep their incomparable sheen only when worn by women and come into habitual contact with the gentle, soft, and warm skin of the wearer. When, for instance, Queen Augusta died it was found that her magnificent strings of pearls were likewise in a persistent decline, and for the reason, indeed, that for many years she had not worn them on her bare neck (which fact was explained by her age) but only around the fabric of the neck of her waist. At that time a treatment of baths in sea-water was prescribed for them by experts; and for several months, under obvious necessary precautions, they were sunk into the sea and thus recovered their old luster.

When, for instance, a collar of pearls is taken from the neck, where, subject to a temperature of 40 deg. C. approximately, it has lain for hours, and is laid upon the marble plate of the dresser, which is perhaps only 20 deg. C. warm, it feels, so to speak, a

(*Concluded on page 172.*)

Correspondence.

MR. RIEDERER'S PROBLEM.

To the Editor of the Scientific American:

Your correspondent who replies to my problem certainly has not studied the question very closely. There is absolutely no doubt as to the possibility of the solution, for taking any single number, it is quite evident that the remaining 14 numbers will make 7 pairs, each one of which with the taken number forming a different combination of three. What one number is capable of doing, every other is, likewise. So that certainly proves that 7 combinations as told are possible. The question is, how can this or any other similar problem be worked out without a haphazard shifting till you get the solution?

Find the system. The problem is all right.

New York city. Herman S. Riederer, Ph.D.

OBSERVATIONS OF A METEOR IN FLIGHT.

To the Editor of the Scientific American:

I have seen no mention in the newspaper of the meteor that fell west of Corrington, North Dakota, on January 10th. It was seen for seventy miles south of Streeter, North Dakota, and passed over us with great speed. It buried itself six feet in the ground about seventy miles north of Streeter. The heat produced was so great that for forty-eight hours no one could approach it closely, notwithstanding the fact that the ground was covered with snow and was frozen to a depth of four feet. When the meteor passed over our heads from a southwesterly direction to northeast, it shone most brilliantly. The noise which it produced can be likened only to that of a very large cannon ball in flight. The diameter of the meteor is 56 inches. It has been taken out and sent to Bismarck. J. J. Rott.

Streeter, N. D.

SOME STRANGE ANIMAL INSTINCTS.

To the Editor of the Scientific American:

Two items in your science column of January 8th, 1910, interest me. That about the return home of the kitten and cat, because there are scientists in your own city and elsewhere who have held doggedly that the special sense of this wonderful ability to go back home is not a special sense, but the result of some sort of observation, although the cat may be blindfolded. They even claim that homing pigeons find their way back by observing "the lie of the country." While this instinct is by no means unerring, and is developed to a much greater extent in some individuals than in others, there seems no justification of the denial to these lower creatures of a faculty of orientation or traversing which man possesses in only a small degree. There are many instances where the return has been made over a route very different from that of the outgoing journey, and could not have been influenced by the topography, even if it could have been observed.

The other instance is that of the magpie which was fond of rubbing tobacco and its ashes into its plumage, as mentioned by the writer in Kosmos. This is of special interest to me, because I had made a similar observation on a bluejay—a relative of the magpie—and had never so far been able to confirm it from any other source. Fortunately as long ago as 1896 I recorded it in my little book "The Story of the Birds" (Appleton) from which I venture to quote:

"I saw him (the jay) engaged in the walnut tree one day in late summer in a manner that made me fear that his bath had not been sufficiently effectual. He would pluck off a leaf, lift his wing and rub it into his plumage. I saw him do it repeatedly; and since walnut trees have a pungent odor and are disagreeable to insects, I feared that he had some guests that he was trying to get rid of. If this theory should be correct, here was a case of a bird using perfumes with at least good intentions." (Page 243.)

It is well known that dogs and other mammals will rub their bodies into or against something that is strikingly odorous, for the sake of the perfume only in which they seem to delight, but these two are the only instances that I know of where birds are recorded as doing the same. It would be interesting to hear from any other instances—if there are any, as is likely. James Newton Baskett.

Mexico, Mo.

RE-ARMING OUR WARSHIPS.

To the Editor of the Scientific American:

In a letter to the Scientific American of September 5th, 1908, a correspondent, Mr. A. B. Wingfield, suggested the re-arming of our "Connecticut" class of battleships with four 12-inch guns in place of the eight 8-inch that are now carried in the main battery of this type. The Editor's comment at the time was that the greater weight of 12-inch gun emplacements on the beam would necessitate too costly structural strengthenings to justify the change, that the 6-inch armor protection would be too light for these emplacements, and that the increase in dead weight would sink the already low armor belt even lower in the water. A previous letter appeared in your issue of August 15th, 1908, and since then changes of this character have been under consideration.

I know that if the Scientific American takes up this matter, its influence will be brought to bear on naval men, the object in view, of course, being to make dreadnoughts of the "Connecticut" type and semi-dreadnoughts of the "Georgia" class. The younger officers in the navy whom I have questioned in regard to this matter are unanimously in favor of these improvements.

As armed at present, the "Connecticut" and "Georgia" classes are not as efficient as a comparatively small additional expense could make them; and in view of the conceded superiority of the all-big-gun type of ship, it seems worth while to consider how it would be possible to so reconstruct the above types as to make them more formidable against dreadnoughts.

The pre-eminent function of a battleship is to concentrate the greatest efficiency and power possible in a single vessel. The armament of the "Connecticut" class consists of four 12-inch, eight 8-inch, 12 7-inch, and twenty 3-inch, of which four 12's, four 8's, six 7's, and eight 3's can fire on broadside. The "Georgia" type mounts four 12-inch, eight 8-inch, twelve 6-inch, and twelve 3-inch, of which four 12's, six 8's, six 6's, and six 3's fire on broadside. Now to convert these ships to dreadnoughts it would be necessary to mount one 12-inch gun in place of the two 8's in each of the beam turrets, keeping the emplacements as they are.

As the 7-inch guns are too small for battle ranges and too slow for torpedo defense, they could be substituted by the 5-inch rapid fires which are now being mounted on all our new dreadnoughts. With say eighteen of these and a few more 3-pounders in place of the present twenty 3-inch guns, the change is complete and you have a vessel the equal of the "Michigan" type, which are really powerful dreadnoughts on a "Connecticut" displacement.

In the "Georgia" class the same renovations could be made, except that the four superposed 8's would have to be retained and the six additional 5's omitted. The "Idaho" and "Mississippi" could be similarly treated. Under this arrangement the armament of the two classes would now be: "Connecticut": eight 12-inch and eighteen 5-inch, with a broadside fire of six 12's and nine 5's. "Georgia": six 12-inch, four 8-inch, and twelve 5-inch, with a broadside fire of five 12's, four 8's, and six 5's. Then our two "Idahos," four "Georgias," six "Connecticuts," two "Michigans," and two "Delawares" would mount 124 12-inch guns instead of 84 as at present, and would practically be a dreadnought fleet. The benefits from these changes are as follows:

1. A homogeneous broadside, giving greater concentration of fire at battle ranges.
2. A simpler system of spotting and fire control, with only one range to get and only one caliber of gun (excepting the four "Georgias") in the main battery.
3. A greater efficiency of ordnance resulting from more uniformity in ammunition and consequent speed in handling.
4. A better organization for and the quicker delivery of shell.
5. An opportunity offered to hold former 7-inch gun crews in reserve for turret crews.
6. The elimination of unwieldy and inaccurate middle batteries with large crews necessary to their service in exposed positions.
7. A smaller number of men in action at the same time and behind heavier armor (i. e., turrets only) at battle ranges.
8. An increase in the efficiency of torpedo defense by a gun more practicable in every way than the old caliber, which was ineffective at 3,500 yards and required the same number of men to handle it.
9. The lightening of the armor belt and bringing it higher out of the water, where it belongs.
10. The placing of the entire main battery behind turret armor.

Now as to the cost. For one battleship of the "Connecticut" class to be improved as shown above, the expense would consist chiefly of the price of four 12-inch and eighteen 5-inch rifles, and the remodeling of the 8-inch turrets and handling rooms. The 5-inch guns could occupy positions behind the old 7-inch barbettes, on the gun deck, the 3-inch casements (slightly enlarged) on the main deck and new mounts for the superstructure. I do not believe that the structural part of the ship would need strengthening in any way. Moreover, all these discarded eights, sevens, sixes, and threes could be mounted on smaller cruisers, where they could do the work required of them, and thus money on new construction could be saved.

I think that you will agree with me in saying that with these improvements made, our pre-dreadnought type will not only possess far greater efficiency than they do now, but also that they will be able to stand in the first line of battle with future dreadnoughts. The real question is this: Is this greater efficiency worth its cost? In view of the slight difference in the cost of maintaining in commission a "Connecticut" and a "Delaware," I think it is, and the Scientific American can do a lot toward making these paper changes realities. Harold M. Kennard.

Brooklyn, N. Y.

[In publishing this interesting study of a much-mooted question, we would point out that it seems to be the unanimous opinion of naval men in all navies that the re-arming of the older ships does not pay; that all appropriations for construction should be put into new ships. Such changes as are suggested above would involve enormously costly structural work on the hulls. There is no room for 12-inch guns in the 8-inch turrets.—Ed.]

The New Supplement Catalogue.

The publishers of the Scientific American have issued a new catalogue of the Scientific American Supplement, in which 20,000 articles are listed. Many of these articles have been translated from foreign publications which are ordinarily inaccessible to English-speaking readers. Many of them also are papers read before the learned scientific societies of the world and accessible only in a few large public libraries. The articles are all carefully indexed so that the best information on any particular scientific subject may be found in a few minutes. The catalogue will be sent gratuitously to all who apply for it.

The Current Supplement.

The current Supplement, No. 1781, contains some remarkable pictures of the Seven Wonders of the World, together with a good article on them. "The Practical Utilization of Insect Parasites" is the title of an article which will interest the farmer. Another installment of the Munroe and Hall paper on "Combustion and Explosion, a Primer on Explosives for Coal Miners," is published. Some new uses of paper are described. Mr. D. A. Arthur contributes an article on Chinese calendars. Since the Chinese have just celebrated their new year, this article comes out with particular timeliness. H. A. Humphrey's paper on an internal-combustion pump is concluded. Leonardo da Vinci, perhaps the only truly all-around genius of the world, is the subject of an excellent article by Edward P. Buffet. The Wright injunction is summarized and illustrated.

Comets Due to Return This Year.

In addition to Halley's, two other comets are due to pass through perihelion this year. The first is known as Tempel's second periodical comet, discovered in 1873 July 3rd at Milan. Its period is about 5¼ years, and it was re-observed in 1878, 1894, 1899, and 1904, making its perihelion passage, on the last occasion, in November; it should therefore return this coming spring. D'Arrest's comet, discovered in 1851, is the second object, and is due to return during the summer of this year. Its period is about 6½ years, and it was re-observed at its return in 1857, 1870, 1877, 1890, and 1897, but it escaped observation, being unfavorably placed, in 1903.

Mr. Lynn, who gives these particulars in No. 418 of the Observatory, also recalls some of the historic occurrences which have coincided with the returns of Halley's comet.

The Scientific American Fourth Dimension Book.

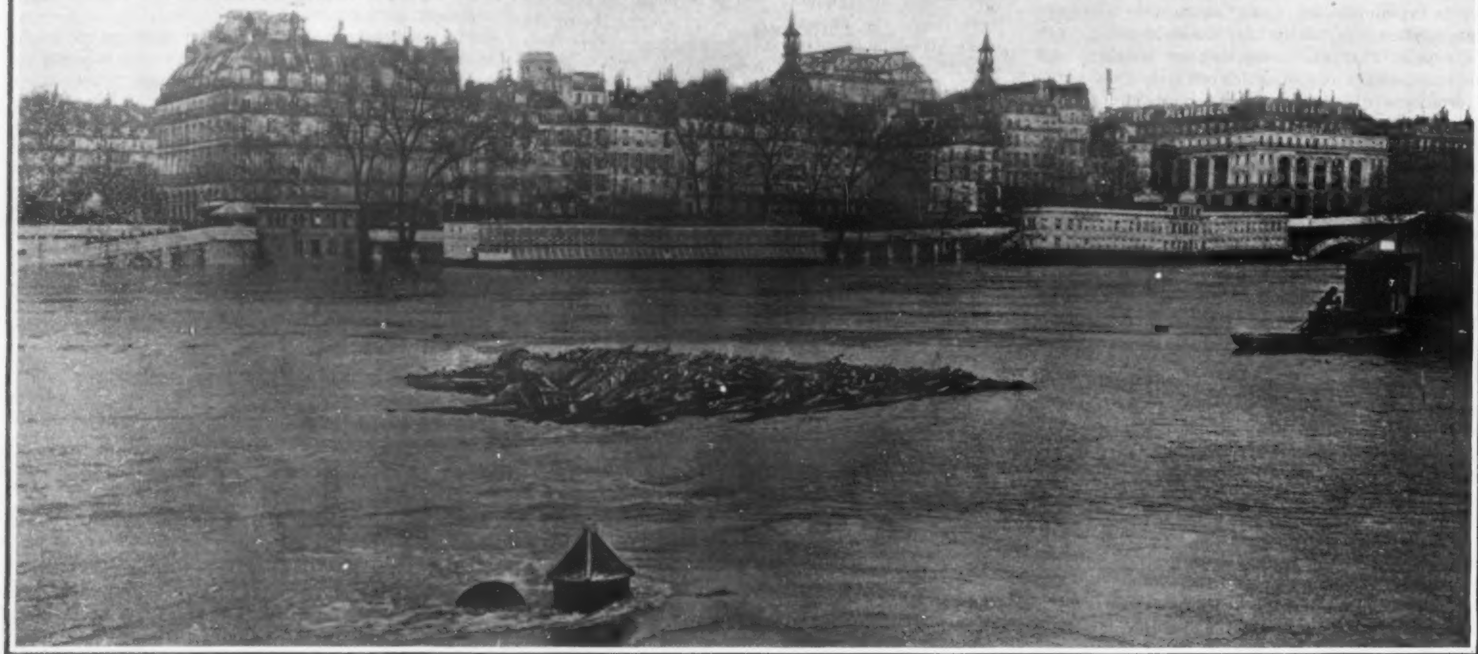
The readers of the Scientific American have hardly forgotten the Scientific American's Prize Competition for the best simple explanation of the Fourth Dimension. The prize of $500 was awarded to Lieut.-Col. Graham Denby Fitch, U.S.A. His essay was published in the Scientific American for July 4th, 1909, and three others, which were accorded honorable mention by the judges, followed in successive issues.

It seemed to the judges that of the 245 essays submitted, a certain number showed more than passing merit. Inasmuch as the popular literature on the subject is by no means extensive, the publishers decided to intrust to Prof. Henry P. Manning of Brown University, one of the judges, the task of selecting some of the best contributions. This Prof. Manning has done. These essays, together with the essays which were awarded the prize and honorable mention, are now published in a book which has just been issued by Munn & Co., publishers of the Scientific American. An elaborate introduction is provided by Prof. Manning, in which he critically and yet simply discusses fourth-dimensional geometry and gives an excellent bibliography on the subject. The book sells for $1.50 and can be ordered through any newsdealer or bookseller.

The deepest coal seams mined in America lie above a depth of 2,200 feet; some of the coal mines in England are developing seams at a depth of 3,600 feet, while coal mining is carried on at a depth of about 4,000 feet in Belgium.

THE GREAT FLOOD OF PARIS

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN



The Seine near the mint.

The inundation of Paris made many of the streets of that metropolis as navigable as the canals of Venice. The highest point reached by the water was 31 feet 4 inches above the normal at the Pont Royal. Not since the historic flood of 1615 has Paris been visited by such an inundation. On January 29th the waters began to fall, and the city for the first time began to feel safe. Even as it was, the Seine was swollen to thirty times its ordinary volume, and the current raced to the sea twenty times faster than usual. The banks have been overflowed for from half a mile to a mile on either side. That vast and wonderful sewer system which figures so dramatically in Victor Hugo's "Les Miserables," and which has been dwelt upon time and time again in every guide book of Paris, and that intricate system of subways which handles the vast traffic of Paris, have both played their part in this catastrophe. They served as conduits for the flood. Huge as they are, they were unable to cope with the turbulent waters. Pavements were pressed upward, and the water bubbled up into the streets. Apprehension was felt for the safety of the monuments of the French capital, an apprehension which is not yet stilled. It seemed almost certain that their foundations would be sapped. It speaks well for the work of French engineers that none of the twenty-four bridges that span the Seine was carried away, and that it was found necessary to close but eight of them. On the other hand, these bridges undoubtedly helped to dam the waters and to aid in the city's inundation. It speaks well for the architects and masons of the middle ages that the famous Cathedral of Notre Dame should have stood in a lake for days and days without suffering injury. Many of the historic buildings of Paris were flooded, but fortunately the art treasures seem all to have been preserved with little or no injury. When the saturated ground dries out and contracts, it may be that some of the buildings will settle and possibly collapse. The Louvre, although flooded, was still able to serve its function of housing its priceless paintings and its statues. The great shops could not be opened on account of the water. The famous Theatre Français still gave its performances, but it used candles as it did back in the days of Molière.

It was but natural that the Chamber of Deputies should have continued its sessions. An exhibition of fright on the part of the legislators would undoubtedly have heightened the public terror. As it was, the members were ferried across the square to the chamber. The old Latin Quarter and the Champ de Mars, the Rue Royale, the Boulevard Haussmann, the Place de la Concorde, the Champs Elyseés, were swamped.

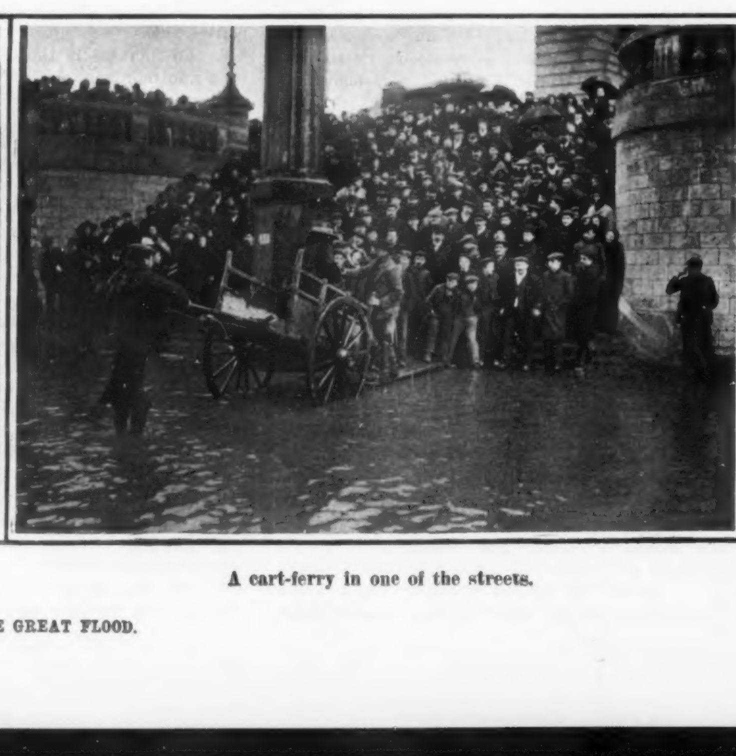
Naturally the subways suffered heavily. Only the Gare du Nord seems to have escaped. The station of St. Lazare seems to have suffered most severely. As it was, the suburban traffic was entirely cut off, so that the sparing of the Gare du Nord served simply to give the frightened populace a place of questionable refuge. Fortunately the waters rose so gradually that the inhabitants of the sewers (the theme of many a thrilling French short story) and of the basements and sub-cellars of Paris were able to escape. Suburban towns lying somewhat lower than the city have suffered. The breaking of a dyke completely inundated Gennevilliers. Its community of 10,000 persons was driven out by ten feet of water.

Paris may now be considered safe from water, but the danger from sickness still prevails. The stench of the stagnant water and of the drowned animals will undoubtedly continue for days. The Paris health authorities will find difficulty in coping with that situation.

The actual cause of the flood has not been fully revealed. Some explain it geologically by arguing that the basin of the Seine had become saturated during a mild winter, characterized by heavy rains and little evaporation. It will be safer before accepting this theory to await the investigation of the municipal engineers. Only when the floods have subsided and a careful examination can be made, will the full measure of the disaster be ascertained. The accounts of bursting sewers and subways and caving streets point indubitably to the necessity of reconstructing much of the famed Parisian sewer and subway systems. It will probably be months before Paris will conduct business as it did before the flood.

The engineering aspects of the flood have been sufficiently discussed in our editorial of February 5th. For that reason the results of this Parisian inundation need not here be dwelt upon again. It is clear that either the channel of the Seine must be widened by dredging, by the removal of river piers, or by the inordinately expensive construction of an artificial waterway around the city, a waterway which will serve the purpose of diverting the surplus of the Seine in time of flood and of discharging it below the city.

The gondoliers of Paris.



A cart-ferry in one of the streets.

SCENES OF THE GREAT FLOOD.

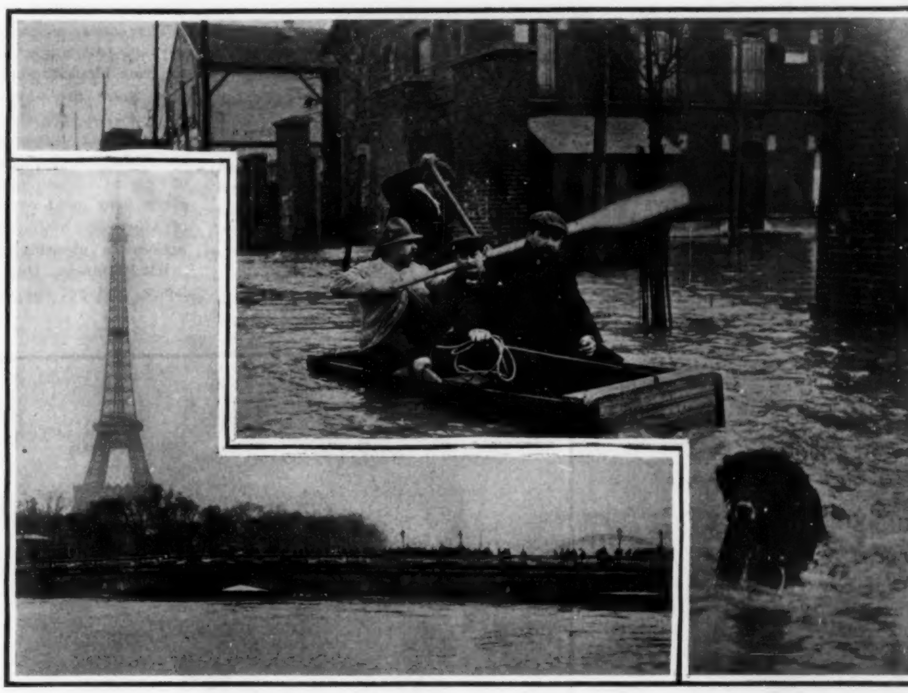
Reclamation of the Friedeburg Peat Bogs.

The total area of the peat bogs and moors of Germany is more than 3,000 square miles, of which about two-fifths are situated in Hanover and Schleswig-Holstein. The Prussian government possesses in East Friesland nearly 40,000 acres of upland moors, of which about 16,000 acres, known as the Anrich, or Friedeburg bogs, have for some years been the scene of an attempt at reclamation, which is being carried on with great skill and energy, though unfortunately with a degree of secrecy which makes it difficult to ascertain the exact facts, although the undertaking is of the greatest and most general importance. It is contemplated not only to reclaim the moors for cultivation and settlement, but also to make them the source of energy which will supply electric current for light and power to the surrounding region within a radius of thirty miles. Electric light, thus obtained, is already supplied to Emden, Wilhelmshaven, and several other cities and towns, and large quantities of ammonia, hydrogen sulphide, and other gaseous products are sold for use in various industries. The district to be reclaimed lies between the Ems-Jahde canal on the north and the Nordgeorgsfehn canal on the south, between which a connecting canal will be constructed. Short canals will connect the system with the canals of the older moor colonies to the westward. In all, 38 miles of new canals will be required. Their construction will necessitate the stripping of about 650 acres of moor, from which it is estimated that nearly 250 million cubic feet of peat will be obtained. If this work were done by the old Dutch method, the canals would not be finished in several decades, during which period the price of peat, already very low in this district, would continue to decline. Both of these difficulties were avoided simultaneously by the adoption of electrical methods, by which the work of excavation is carried on very rapidly and supplies its own fuel. In the center of the moor is a boiler plant, which consumes peat exclusively. The problem, of course, will be still more simplified when a method of producing electricity directly from heat is developed.

The first settlers established on the Friedeburg moor will carry on what is known as surface cultivation, and will at the same time gather peat, which they will sell to the electrical company, the charter of which runs for seventy-five years. As the high moor is thus cut down, the method of cultivation will be gradually changed to that which is employed in the low-lying moors of Holland.

All of the energy is supplied from the central power station of the Siemens-Schuckert Company, situated on an island in the bog at the intersection of two main roads. From this point wires, supported by poles, radiate in all directions, supplying light and power to the whole country for many miles around. The main canal is bordered by several rows of poles and wires, one for the telephone, another for the peat-digging and agricultural machinery, a third for the high-tension alternating-current long-distance service. Current was to be supplied to the surrounding cities in November of this year. The station is equipped with two steam turbines of 1,800 horse power each. The great plows used for the excavation of the canals have long been driven by electricity. The peat dug each day is compressed by electric presses into 4,000 blocks, which when dry are used as fuel in the central station. In the gas generators 40,000 cubic feet of fuel gas and 30 pounds of ammonium sulphate are obtained from 100 pounds of peat. The combustion of this quantity of fuel gas generates 273 horse-power hours of energy, while the sale of the ammonia compounds pays a good interest on the capital invested. Contracts for supplying light and power to most of the surrounding towns and cities have already been signed. The duration of the contract in most cases is forty years, while the charter of the Siemens-Schuckert Company will remain in force seventy-five years. The area assigned for cultivation and settlement comprises about 17,000 acres. The digging of the canal requires the peat to be removed from a strip about 150 feet wide, so that the construction of the 38 miles of canal will involve the stripping of 650 acres. The average depth of the peat is 11½ feet. Deducting the superficial stratum of 30 inches, which is comparatively worthless, the digging of all the canals will produce about 247 million cubic feet of peat, which when dried will furnish 1 1/3 million tons of fuel peat. This amount of fuel alone would supply the central station, producing five million kilowatt hours of energy for sixty-six years. On each side of each canal, a strip 165 feet wide is to be cleared of peat for cultivation and settlement. The peat thus obtained, added to that obtained from the canals, would enable the capacity of the station for the duration of its charter to be tripled.

An idea of the cost of the electric light and power thus furnished may be gained from the contract recently concluded with the town of Baut, in which the price of lighting current is fixed at about 10 cents, and that of power current at 5 cents, per kilowatt hour. At these rates a 16-candle carbon incandescent lamp or a 40-candle metal filament lamp would cost about ½ cent per hour, and an arc lamp from 2 to 6½ cents per hour, according to its candle power. Thus the Friedeburg bogs are to be utilized as a field for colonization, as a source of light for the surrounding country within a radius of 30 miles, and as a cheap and reliable source of power for all the cities and farms of East Friesland. Although all the hopes which have been built on the enterprise may not be fulfilled, it is already certain that the reclamation and cultivation of bog land has entered upon a new and promising stage of development in consequence of this application of electricity. It must be admitted, however, that on the Friedeburg moor the conditions for reclamation are especially favorable. The land is in general level, and it has already been superficially dried and smoothed by burning. The roads through the moor are already bordered with rankly-growing grass.



Scenes from the great Paris flood.

Peary a Rear Admiral.

Commander Robert E. Peary has been made a rear admiral of the highest grade and with maximum pay, so far as the Senate can accomplish such recognition of his services. The bill recently introduced by Senator Hale was favorably reported from the Committee on Naval Affairs and promptly passed without discussion.

The bill authorizes the President to appoint Commander Peary a rear admiral with an extra number and places him on the retired list. An amendment was adopted giving him the pay of a rear admiral of the first grade.

The top notch pay of a rear admiral is $8,000 a year and that of the same officer on the retired list three-fourths of his active compensation. Thus Admiral Peary will receive $6,000 a year for the remainder of his life.

The Gare du Quai d'Orsay flooded.

The submerged Rue de Lyon.

THE GREAT PARIS FLOOD.

Industrial Chimneys and Water Towers of Concrete Blocks

BY H. PRIME KIEFFER

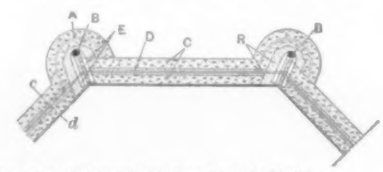
The employment of concrete blocks for the construction of factory or industrial chimneys and water towers, is one of the most natural uses of that new form of building material. It is very surprising that the idea of utilizing separately molded blocks for this purpose should have come from Europe instead of America, where blocks have found a wider range of use than in any country in the world. The system is the ideal one for the rapid erection of factory chimneys. In the United States there have been in use some twenty different systems in which armored concrete is employed, but they all have some primary form of scaffolding in their designs. This is the underlying reason why those chimneys cannot be constructed more economically and rapidly. The method of constructing chimneys of separately molded concrete blocks is the invention of M. Dumas, an engineer and architect of Brussels, Belgium. It is controlled by Leon Monnoyer et Fils, also of Brussels, who furnished the data and photographs for the present article. The system is notable for its simplicity, its beauty of form, its economy in cost, and its adaptability to rapid construction.

The chimneys are like all others in that they are composed of three parts, the foundation, the base, and the shaft. The shaft is formed of reinforced concrete of a special design. The form of the blocks is shown in the accompanying diagram. The number of blocks in each course always remains the same, yet there is a taper to the chimney. They are placed in regular horizontal courses to the required height, and upon the top is placed a special capping block of either concrete, cast iron, or cut stone.

The builders work on a rough platform and from the interior of the structure, and each block is received by them ready for its particular position. Two men are usually employed above in laying the blocks, and two below to hoist them to the platform. The blocks in each succeeding course are placed in the opposite direction; that is to say, all the even courses will have the same direction and all the odd courses will take the reverse of this. In this manner, the joining of the blocks of one course, where they do not meet perfectly, will be covered by the blocks in the course above. As shown in the diagram, each block has at one of its extremities, a "hook" similar to the shape of the letter "U." This "hook" forms a hollow space which extends the full length of the chimney, and of course there will be just as many of these hollow spaces as there are sides to the chimney. Through these vertical hollow spaces are placed vertical iron rods B, varying in diameter according to the height of the structure. At each course these rods are tied or bound to the courses by U-shaped flat iron yokes *E*. These, in turn, are wired to a small iron rod D which is placed between the courses horizontally and in a groove made for it in the top of the blocks.

The placing of the vertical rods in the openings and not in the substance of the shaft proper, forms an important advantage of this system. The reinforcement is thus kept at a low temperature, and is not subject to the injurious effects which would arise from unequal expansion if the steel was in the center of the mass. Ferro-concrete is indestructible by fire, so long as the temperature of decomposition of concrete is not reached; but it must be remembered that although the co-efficients of expansion of cement are the same, the co-efficients of conductibility are very different, and fracture is likely to arise if, from this cause, the temperature of the iron exceeds that of the concrete. Consideration of this condition is especially important in the case of a structure which is heated on one side only, such as a chimney.

A clever idea in connection with the design of the blocks is that there is need for only three, or at the most, four sizes of blocks for the average chimney of



A. Indicates the hidden reinforcing rods of the blocks.
B. The vertical steel reinforcing rod.
C. The concrete of the block.
D. The reinforcing rod connecting all the blocks in any one course.
E. A flat U-shaped iron brace which holds the vertical rod at a fixed position in the hollow space.
R. Mortar filling.

Cross section of a portion of a concrete water tower. Section at one end of the joining of two of the courses.

150 feet high and with a taper of one to three per cent. This is made possible by the following arrangement: The molds by which the blocks are made consist of but three cast-iron plates, held together by wooden stop blocks, and three ordinary iron clamps. Different sizes of blocks can be made therefore, by simply changing the relative positions of the plates and the wooden stop blocks. After the blocks are molded, they are placed in the following manner. Take, for instance, the first row, at the base. Here, naturally, the blocks are of the largest size, and the arm of the block the longest. The arms of the blocks in this course are placed just to the edge of the hooks of the blocks, and in the next course the arms are placed just a little farther into the hooks, and thus each succeeding course has a diameter smaller than the one below it, and in this manner, the taper of the chimney is obtained. As the longest blocks are some three feet in length and the distance across the semi-circular opening about six to eight inches, it is possible to make a considerable taper in this manner. For a taper of 1½ to 2 per cent, the size of the blocks is changed every forty or fifty feet. The blocks may, of course, be laid with absolutely no taper, and then one size, only, of blocks is used. Some chimneys have been constructed on this plan; but their appearance is not so graceful as those having a slight taper.

The concrete blocks are usually made at the chimney site, although they can of course be molded at a concrete block factory; and this may be economical in case there are several chimneys under construction in the same district. The proportions for the concrete mixture vary somewhat, but the usual mixture consists of about five parts gravel, three of sand, and two of cement. Dust of stone is used sometimes, and has given very good results. From an architectural point of view, the chimneys constructed with this system present a pleasing appearance. Being thinner than brick chimneys, they rise more gracefully from their bases, and yet the strength and stability which they actually possess is at once suggested to the eye by the appearance of strength which is presented by the protruding rounded angles.

A number of chimneys and water towers have been built in Europe after this system, and the two photographs presented in connection with this article show a water tower, and a combined water tower and chimney. The water tower, which is located in Uccle, a suburb of Brussels, Belgium, will be used in connection with the 1910 exposition to be held in that city. The tower and tank have a height of 145 feet and the latter has a capacity of 280,000 gallons. The structure is circular and is built entirely of concrete blocks and without molding of any kind excepting that used in the building of the concrete reinforcing struts surrounding the base of the tank proper. The inside of the tank is built up in practically six stories, connected by a winding stairway. These different floors are divided into rooms, which will all be occupied by engineers, foremen and other workmen during the exposition. The stairways are placed along the outer walls and the water remains in the center, inclosed by a concrete covering of square cross section.

Concrete-block chimney carrying two reservoirs of reinforced concrete.

Concrete-block water tower for the 1910 International Exposition at Brussels, Belgium.

INDUSTRIAL CHIMNEYS AND WATER TOWERS OF CONCRETE BLOCKS.

Oil That Cold Will Not Affect.

It is often difficult to keep machinery properly oiled in cold weather, as the oil freezes in the oil holes and the cups, and the oil upon the ways of the lathe and planer becomes stiff, causing the machines to work hard. A good oil for winter use is made by mixing graphite with cylinder oil until in a thick or pasty consistency, and then adding kerosene until it flows freely. This oil will not become stiff at 14 degrees below zero, and is valuable to those operating machinery outside or in cold shops.—Power.

In his presidential address to the American Street and Interurban Railway Association, Mr. Shaw, at Denver, said that in round numbers there are 1,250 street and interurban railway companies in America, with a total of 35,000 miles of single-track and 75,000 passenger cars. The passenger carried annually is 10,000,000, and the gross income $44,000,000.

THE CONSTRUCTION OF AN IMPROVED SILICON DETECTOR.

BY GEORGE F. WORTS.

The detector described here is one that can easily take the name "Improved," being a radical departure from the coarsely-adjusted detectors generally used. If properly constructed and connected, it will easily pick up wireless messages sent from very distant points. The component parts are shown in Fig. 1.

The base of the instrument is fashioned from hard rubber, 3 x 2 x ½ inches; ⅛-inch holes are bored in it one inch from either end. A support for the crystal cup is made from annealed brass, 4 inches in length, ⅜ inch in width, and 3/16 inch in thickness. It is bent to an L shape, as can be seen in Fig. 2.

The crystal cup is turned from brass rod ½ inch in diameter. It is threaded, as seen in Figs. 1 and 2, to fit a thumb nut. The crystal is fastened in the cup by means of lead. This insures a good contact. The adjusting mechanism can be made to move a steel hair spiral, the point of which makes contact on the silicon, to the thousandth part of an inch. The phosphor-bronze strip upon which the spiral contact is fastened is 3 inches in length, ½ inch in width, of No. 28 B. & S. gage sheet. It is bolted to a cube of brass which in turn is fastened by means of a machine screw to the base. This screw serves also as a binding post. The brass post supporting the adjusting screw is of 3/16 inch brass of the same stock as the L-shaped post. It is 2¼ inches in length, ⅜ inch in width, and 3/16 inch in thickness. A ⅛-inch hole is bored ½ inch from one end to admit the machine screw that binds it to the brass cube. Another hole is bored ¼ inch from the other end and tapped to fit the adjusting screw. The adjusting screw has a large knurled rubber handle for adjusting purposes, also a lock nut to be tightened when the detector is at its most sensitive point.

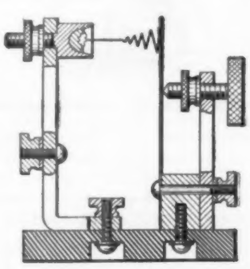


Fig. 1

SECTIONAL VIEW OF THE ASSEMBLED DETECTOR.

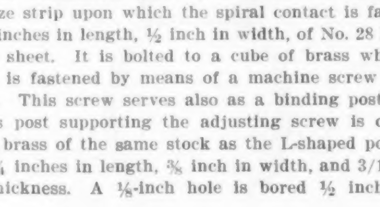


Fig. 2. Fig. 3.

SUPPORTS FOR THE CRYSTAL AND THE ADJUSTING DEVICE.

This detector is comparatively easy to construct and is inexpensive. The one undesirable quality in silicon detectors—their ability to get out of adjustment—is almost entirely eliminated in this detector, due to the use of the spiral instead of the solid contact.

INCREASING THE EFFICIENCY OF WIMSHURST ELECTRIC MACHINES.

BY GEORGE J. MURDOCK.

The Wimshurst static electric machine, as is well known, consists of two glass circles revolving on a compound axis in opposite directions. As usually made, this machine is inferior to the Toepler-Holtz type, although somewhat cheaper to make, and superior in simplicity. The latter quality has been without doubt one of the chief reasons why it is in general use wherever the small electric discharge this machine will give as commonly made, will answer the purpose.

In building both kinds of these interesting machines, it is the practice to varnish the revolving glass circles with white shellac dissolved in alcohol. In the higher grade machines the best quality of shellac and grain alcohol are used for this varnish, but for the toy variety wood alcohol and the cheapest grades of shellac are used. Some years ago the writer was building both Wimshurst and Toepler-Holtz statics, but was unable to obtain a discharge from the Wimshurst type that could compare with the other kind, even when the glass circles were of the same diameter.

The development of the machines in both cases had extended over a series of years, and it was supposed the limit was reached. At this time the Toepler-Holtz machines were giving with 26-inch circles, sparks (using the Leyden jars) equal to the radius of the circles or 13 inches long, thick as the thumb, and when discharging detonating like the sound of a rifle.

The Wimshurst machines with an equally large circle would not give sparks over 4 inches long, and about as thick as a knitting needle. Finally, in building a lot of six machines it was found some were much better than others. Strenuous efforts were made to ascertain what caused the increase in efficiency, but without discovering anything different in the construction of those that showed the improvement from the others. In the next lot after this, however, all of the machines were capable of giving sparks 6 inches long, although the diameter of the glass circles was but 14 inches. The thickness of the spark had also increased to the size of a pipe stem, and this wonderful increase of efficiency was attributed to some quality inherent in the glass of which the circles were made, but inquiries made of the manufacturers of the glass failed to disclose any different methods of making the glass than had been followed for many years.

About this time the writer in varnishing some circles held one of them up to the light, and was struck by its light green appearance, and although giving it little attention at the time, gained the impression that this change in color might have something to do with the increased efficiency still unaccounted for. Shortly after this a new lot of machines were built, and every one of them had reverted to first principles so far as the spark was concerned, it being short, weak, and spindling. In the effort to find out what had caused the reversion, the writer called to mind that just before varnishing the last lot a new brush had been used in a new batch of varnish.

It is customary in making the varnish to dissolve the shellac gum in a glass jar with a mouth just large enough to get the brush in conveniently, and the brush is left in the jar between the construction of the different lots of machines. It was found that the old brush had been shedding its bristles, and to prevent this it had been bound around with some fine copper wire. The action of the varnish had been to corrode the copper, and the salt had given the varnish the faint green color noticed some time before on the glass circles, although there had been nothing different in the color of the body of varnish in the jar apparent.

The suspicion dawned on the mind of the writer that this had been the cause of the increase of efficiency, and the lack of it in the last lot of machines. Another batch of varnish was accordingly made, and in it was put about a quarter of a pound of fine bare copper wire. A new brush was procured, and placed in the jar, and the varnish allowed to stand in a warm, dark room about a week, when it had assumed a light green color, and was used to coat the circles of a new machine.

This machine was found on trial to be even more efficient than the best of the others.

In experimenting with the newly-discovered varnish, it was found that if it was allowed to become a dark green the voltage of the machine was interfered with, and while the spark would be thicker it would not jump as far. The best results were obtained when the color was a very light green. The reason for the increased efficiency was thought to be due to a decrease of the resistance of the shellac between the sectors on which the equalizing brushes bear.

This varnish was tried on Toepler-Holtz machines without their showing any marked increase, perhaps due to their being already capable of delivering sparks equal to the radius of the glass circles.

The use of varnish made in this way will be found by amateurs and others to add greatly to the capabilities of the Wimshurst machine, and besides the light green color on the glass adds to the beauty of the instrument.

Many builders of Wimshurst machines as well as those experimentally inclined have trouble in making the brass sectors stick to the shellac. As tinfoil soon wears through from contact with the equalizer brushes, thin sheet brass is used by many on the better grades of machines to secure durability. Brass sectors can be made to stick permanently in the following manner:

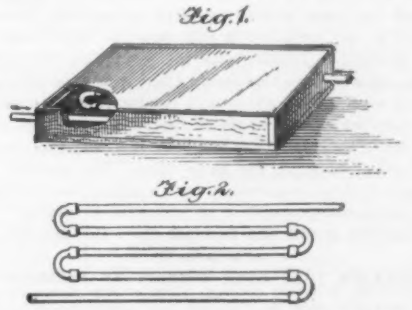
In varnishing the circles, about three coats is generally applied with a large flat camel's hair brush. Each coat is allowed to become moderately hard before applying the next. After the last coat is applied, and has stood about fifteen minutes, mark the locations where the sectors are to go (they should be evenly spaced), and after applying some varnish to the under side of the sector, press it down into the soft varnish until a slight ring swells up around the margin of the sector. After the varnish is hard, an examination will show the sector dovetailed into the varnish, from which it will never separate, as it will if cemented in any other way on account of the expansion and contractions of the brass being so much greater than the glass, and causing the sector to become loose.

SILVERING GLASS AT HOME.

BY A. J. JARMAN.

A good glass mirror, made with one's own hands, is a thing to be proud of. Mirrors are now seldom made by the tinfoil and mercury process, because of the dangerous character of the work, but pure silver is used instead. The silver process is not in the least dangerous to the workman. The formula here given is one that has been in use in several looking glass and art mirror factories in the city of London. The chemicals used must be of absolute purity (chemically pure) and all operations in preparing the glass must be carried out with care and scrupulous cleanliness. The surface to be silvered must not be pressed upon by the fingers or thumbs, they would leave an indelible impression.

Fig. 1. Fig. 2.



APPARATUS REQUIRED FOR SILVERING GLASS.

The first thing to be done is to make a small table out of a piece of slate about ⅜ or ½ inch thick, 10 or 12 inches wide and 18 inches long. These measurements are not binding, any piece of slate about the above size will do. A wooden trough must be made with grooves at the top edges for the slate slab to rest in. There must be a space of 2 inches between the slate slab to the wooden bottom, as indicated in Fig. 1. In this space is a coil of pipe arranged as shown in Fig. 2. The pipe is of about ⅜ inch bore, and through it steam is passed to raise the temperature of the slate slab to about 120 deg. F., in fact just hot enough for the hand to bear. The steam can be supplied from an ordinary tea kettle placed near the depositing table with a rubber tube connecting the coil to the spout of the kettle. Uniform heating of the slate slab is essential. The coil can be easily made of ¼-inch iron gas piping, screwed into U-shaped cast-iron connectors, as shown in Fig. 2. The slate slab can be covered with black oilcloth and made perfectly level. The following stock solutions must be made up and carefully filtered through absorbent cotton, ready for use:

Stock Solution A.—Nitrate of silver, 3 ounces; distilled water, 10 ounces; strong water ammonia, 12¾ ounces. This solution must be stirred well and allowed to stand five or six hours, then add 10 ounces more of distilled water and filter.

Stock Solution B.—Rochelle salts, 4 ounces; distilled water, 20 ounces.

Stock Solution C.—Distilled water, 40 ounces, protochloride of tin, 5 grains.

Clean the glass plate or plates with very fine rouge and water, taking care that no trace of grease whatsoever comes into contact with the glass or the cloths or chamois leather used for polishing. When cleaned, the plate must be flooded all over with the tin solution. Pour this solution off and wash the plate well with distilled water. Lay the plate wet side up upon the table, with four clean wood wedges at each corner. Let the glass rest on the wedges, so as to allow a slight adjustment, if required, for leveling. The mixture for silvering is made up as follows:

Distilled water, 20 ounces; stock solution B, 1 drachm by measure; stock solution A, 1 ounce by measure. The glass plate being quite level, and still wet, pour this mixture carefully and slowly upon the center. It will flow evenly all over until it stands about one-eighth of an inch deep all over the plate. Any tendency to run to one end must be rectified by the wedges. The plate now being completely covered with the silvering mixture must be left to itself for about two hours, the heat being kept up during this time, and when it is found that the whole of the silver has been deposited, the liquid must be poured off by tilting and allowed to run into a stoneware crock and saved

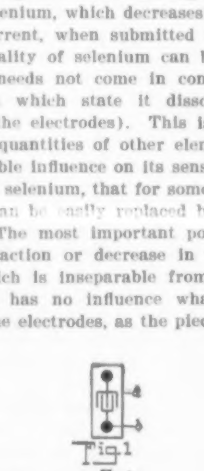
for the waste silver it contains. If it is desired to increase the thickness of the deposit of silver, the operation must be repeated as soon as the silvering is complete; wash the plate well in a soft stream of running water, stand it cornerwise to drain and dry. When dry the following protective varnish must be used as a coating to protect the deposited silver: Shellac, ½ pound; wood alcohol, 6 pints. As soon as this coating has dried it must be painted over again with the following paint: Red lead, ½ pound; white lead, ½ pound; mixed with enough boiled oil and a small quantity of turpentine to make a good covering with a single coating. A small quantity of gold size must also be added to insure quick drying and a tough adhering quality. The mirror is now ready for framing. If much work has to be done, it will be advisable to cover the slate all over with a piece of felt, and keep the felt wet during the operation for two reasons: First, no pieces of woollen fiber can settle upon the plate, and secondly, the heat from the slate slab is communicated to the glass better than from a dry surface.

For a regular workshop a very good size is 4 by 7 feet, with a gutter cut around the slab, so that the spent silvering liquid can run from the tilted plate, around the table, and be collected by running through a hole at one corner. In this case the liquid will be sure to come in contact with the felt. This will prove of no consequence, because in time it will become saturated with silver, which will realize twenty times its first cost when sent to the silver refiner, and not only pay for a new felt covering, but increase the size of the pocket book at the same time. The quantity of nitrate of silver required to coat a square foot of glass with a moderate coating of silver is 18 grains. An estimate as to cost can be made from this amount.

SELENIUM CELL WITH CONTACT BY PRESSURE.

BY W. S. GRIPENBERG.

The usual method of making a selenium cell consists in pressing the electrodes against a piece of crystallized selenium, which decreases its resistance to an electric current, when submitted to the action of light. The quality of selenium can be perfectly controlled, as it needs not come in contact with metal when fluid in which state it dissolves nearly all metals (i. e., the electrodes). This is of importance, because small quantities of other elements sometimes have considerable influence on its sensitiveness. Moreover a piece of selenium, that for some reason has lost its efficiency, can be easily replaced by another piece, at low cost. The most important point, however, is that the contraction or decrease in volume (5 to 8 per cent), which is inseparable from the process of crystallization, has no influence whatever upon the contact with the electrodes, as the piece of selenium is



SELENIUM CELL WITH CONTACT BY PRESSURE.

given its definite form after the contraction has taken place. Strong currents of short duration do not lead to the destruction of the cell, as there is full scope for expansion.

Despite these important facts, this method has not been hitherto used, because very thin plates of selenium are necessary, as the action of light is limited to an extremely thin layer of the exposed surface (calculated by Marc to be about 1/500,000 inch thick). Moreover, selenium is rather fragile and being of high resistance, heavy pressure must be used in order to realize good contact.

The author discovered that selenium, when molten between a cold and a very hot glass plate, strongly adheres to the latter, after the crystallization. It is thus possible to cover a thin (1/250 inch) flexible glass plate with an exceedingly thin coating of selenium (1/1,000 to 1/30,000 inch) which has a highly polished surface that gives very good contact with the electrodes. These consist of gilt stripes on a glass plate (Fig. 1). There are from 250 to 2,500 electrodes on every inch.

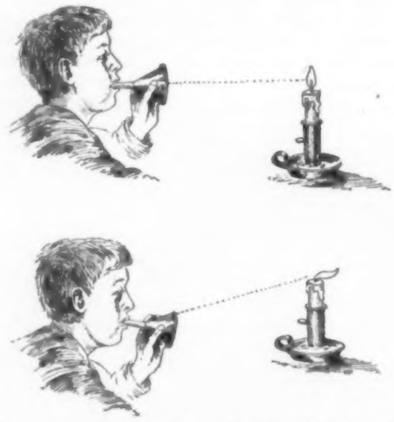
Cells constructed after this method are very reliable and show remarkable constancy. They are of small specific working surface. The following is a description of a cell actually made:

Working surface = ¼ by ¼ inch.
Resistance in the dark = 20,000 ohms.
Resistance in ordinary daylight = 10,000 ohms.
Resistance in strong light = 3,000 ohms.
Maximum intensity of current = 0.0018 ampere.
Fig. 2 gives a diagram of the cell.
Fig. 3 is an end view of same.

Glass plates with a thin coating of metal (silver) have before now been used as electrodes for substances sensitive to light. This combination or at least the results attained are new.

SOME SCIENTIFIC AMUSEMENTS.

The Candle and the Funnel.—Ask a person to extinguish a lighted candle, two feet distant from his mouth, by blowing through a common tin funnel with his lips applied to the stem. Almost invariably, he will fail to accomplish the feat, although he could easily have blown out the candle without using the funnel. Now put your own mouth to the stem of the funnel and blow out the candle. If you have any skill in performing tricks you can repeat this one many times without betraying its secret to the average spectator. The secret is this: When you blow into the small end of a funnel, your breath follows the inner surface of the cone, and not only shuns the axis, but produces eddies of such a character that there is actually a slight back draft or inward current at the center of the wide mouth of the funnel. You, therefore, hold the



RIGHT AND WRONG WAY OF BLOWING OUT A CANDLE.

funnel so that some part of its conical surface would, if extended, strike the candle flame. An inexperienced person naturally directs the axis of the funnel toward the candle and consequently fails to extinguish the flame. If he stands quite near the candle and blows gently the flame will even be drawn toward the funnel by the inward current. The whirling motion of the air may be made visible by using a glass funnel and filling it with tobacco smoke.

Paradoxes of Ebullition.—Everybody knows that water boils at the temperature of 212 deg. Fahr. But if an uncorked bottle partly filled with water is set in a saucepan containing water in which a good deal of salt has been dissolved, and the pan is heated over a spirit lamp or otherwise, the water in the bottle will begin to boil while the water outside still remains perfectly quiet. Yet the water outside must be at least as hot as the water inside (212 deg. Fahr.), for the latter is heated by the former. Hence we see that water which contains salt in solution does not boil at 212 deg. Fahr. The same effect is produced by dissolving any other solid substance in the water.

Now, if the bottle is taken from the hot brine and corked, the water in the bottle stops boiling, but it will boil again, even after it has cooled many degrees, if cold water is poured on the upper part of the bottle. The explanation is that the boiling point of water is affected by pressure. It is about 212 deg. Fahr. under the ordinary pressure of the atmosphere (exactly 212 deg. when the barometer stands at 30 inches), but if the pressure is reduced, water boils at a lower temperature. When the water bottle was corked and taken from the fire, its upper part was filled with steam at atmospheric pressure, which had expelled the air originally present. As the bottle cooled, this steam partly condensed and its pressure was diminished, but not sufficiently to permit the water to boil, because the water cooled also and its gradually diminishing temperature was always a little below the boiling point corresponding to the actual pressure. But the application of the cold water caused a rapid condensation of steam and a sudden lowering of the pressure without having much cooling effect on the water, which consequently began to boil.

Distillation.—The same apparatus may be employed to illustrate the process of distillation. The brine in the pan is replaced by fresh water, a hole is bored in the cork and a glass tube is fitted to the hole. To the water in the bottle is added one-tenth its volume of alcohol, or less. The bottle and pan are placed over the lamp, as before, and heated gently. Before the water in the pan has reached the boiling point the vapor of the more volatile alcohol (mixed with a little water vapor) issues from the end of the glass tube, where its presence can be detected by its odor or by the application of a lighted match, which will result in the production of a tall blue flame. The jet should not be lighted until the mixture has been heated long enough to expel the air from the bottle, as the ignition of a mixture of air and alcohol would produce a violent explosion. For this reason the cork, though it should be air-tight, should not be inserted too tightly. With this precaution an explosion will drive out the cork, instead of shattering the bottle. This experiment, and the others performed with this apparatus, should not be attempted by children or careless persons.

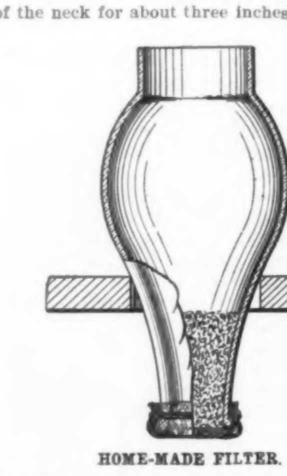
Hero's Fountain.—If the jet of flame issuing from the tube is extinguished and the tube pushed down until it dips into the water, a fine liquid stream will

MODIFIED FORM OF HERO'S FOUNTAIN.

be thrown high in the air by the pressure of the mixed vapors of alcohol and water in the upper part of the bottle.—Kosmos.

A SIMPLE EFFECTIVE FILTER.

The filter here described was first made by the writer in 1878, and used originally for filtering gelatine emulsions. As a water filter it is both simple and effective. Procure an ordinary kerosene lamp chimney. Fit over the end of it two or three thicknesses of washed cheesecloth. Press a tuft of absorbent cotton into the small part of the neck for about three inches in depth, insert



HOME-MADE FILTER.

the chimney, and place it in a hole cut in a wooden shelf as a support. Pour the water in until the filter is filled, when it will be observed that any organic matter, chips of iron rust, etc., will be retained by the cotton. The fine organic matter may penetrate the cotton for about one inch, but no farther. The resultant filtered water will be bright, clean, and pure.

A paper dealing with "Research on Metallic Filament Lamps," by Mr. F. H. Reakes Lavender, was recently presented at a meeting of the Birmingham Institution of Electrical Engineers. The research was undertaken in order to investigate the conditions of working as regards voltage, and efficiency and percentage drop in candle-power, giving the most economical life in the case of metallic filament glow lamps, and to determine as far as possible the cost of illumination with this source of light. The author stated that the useful life of a lamp, and the drop in candle-power which it was advisable to allow for a given voltage, depended on the cost of current and the price of the lamp. The cheaper the current, the longer the life, and the greater the admissible drop. Taking the current at 5d. per unit as an average price, and the lamp run at rated voltage, then it paid in the case of the tantalum class of lamp to throw it away as soon as the candle-power had fallen to 3 per cent below its original value. This result appeared startling at first, considering the large initial cost of the lamp. However, by the time that point was reached the lamp had been burning for 1,500 hours at the best possible efficiency, so that the cost of the lamp per candle-power had become small.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

ARTIFICIAL AIGRET AND LIKE ARTICLE.—M. VEIT, New York, N. Y. The aim in this case is to provide an artificial ornament, such as an aigret, plume, feather, hat and dress trimming, military ornament, hair ornament and the like, and formed from a sheet of celluloid or other material, and arranged to provide graceful filaments projecting integrally from a self-sustaining core.

BODY-BRACE.—R. F. MACCLEMMY, New York, N. Y. This invention relates more particularly to a shoulder brace, in which there are two back sections, each having an arm hole therein, lacing or cords connecting the sections together, and belt sections connected to the ends of the cords and buckling together in front to adjust the back sections in respect to each other. Mr. MacClemmy has invented another body-brace, and one of its main features resides in the construction of the upper ends of the stays, so that one of the stays is secured across its top and the other is left partially free; so that it may overlap the first-named stay, and the intermediate portion will be folded to a definite and predetermined position.

Of Interest to Farmers.

CONCAVE FOR THRESHING-MACHINES.—W. L. HAY, Franklin, Tenn. This improvement is for use for threshers of all kinds. It provides a concave having adjustable sections so that one of the sections may be shifted to disengage the teeth without disturbing the relative position of the teeth immediately adjacent. Simple means are provided for effecting the adjustment.

HARROW.—A. M. HAUCK, Seattle, Wash. This invention relates to harrows provided with wheels for cutting or pulverizing the soil or clods. The invention provides means whereby the shafts upon which the wheels are mounted may be moved toward and from one another, in order to vary the degree of fineness with which the earth is pulverized.

Of General Interest.

BATTLESHIP ARMOR.—E. P. WATSON, SR., Bentonville, Ark. The armor is such as carried by battleships, protected cruisers, and other warships. Merchant ships can be constructed near the water-line in accordance with the present improvement, but the shell-resisting parts of the armor may be omitted during peace, but applied to the ships so as to transform them into armored ships of war.

PROCESS OF WIRING BOTTLES.—O. TOPP, Blaagaardsgade 16a, Copenhagen, Denmark. The invention is especially adapted to prevent the twisted sharp edges of wire from sticking out and thereby constituting a common source of danger from cuts and wounds to those who later on have to handle the bottles. The process can be carried out by hand or with a pair of pliers.

LIQUID-COOLER.—E. RUSSELL, New York, N. Y. An object of the inventor is to provide a cooler in which ice or other refrigerating substance is contained in a vacuum and is surrounded by vacuum chambers, to minimize the melting of the refrigerating substance, owing to the transmission chamber, and which has means for conducting the fluid to be cooled, through the refrigerating chamber.

SCREEN FOR IRRIGATING-DITCHES.—T. A. POWERS, Slack, Wyo. This invention is an improvement in screens for ditches, especially for irrigating ditches to be placed at or near head gates. In operation the screen will stand normally when the gate is in position for use at an angle of about forty-five degrees, hinged at its lower end and adapted at its upper end to be depressed down stream by the action of pressure from above and to permit the debris to pass after which the screen may be readjusted to position for use.

DISPLAY-RACK.—J. A. BOGAR, Lykens, Pa. This invention relates more particularly to such racks as are provided with frames, on which rugs, wallpaper or the like can be suitably arranged for display purposes, and which are further provided with means whereby any number of objects on display can be temporarily removed from the frames to disclose a desired one originally concealed by the same on account of their super-position.

FOLDABLE TABLE AND ATTACHMENT THEREFOR.—H. F. THOMAS, Natrona, Pa. This invention refers to an improvement in foldable legs for tables and in a pedal attachment for such legs. It is particularly designed for use with tables, or like supports, for portable foldable dark rooms used for photographic purposes, but it is not restricted to such use.

Hardware and Tools.

COMBINATION-PADLOCK.—L. ROSEN, Union Hill, N. J. In this case a locking mechanism is controlled by a combination mechanism. The device is intended to be strong in construction, inexpensive and of a type that cannot be readily picked. Simple means provide for a series of combinations that may be changed almost indefinitely.

LOCK.—J. JUNKUNC, Pocatello, Idaho. In the arrangement of this combination padlock the combination may be easily changed, and should any one attempt to discover the combination by bringing the recesses into register, with the bar withdrawn, such attempt would be thwarted, since the combination would not answer after the disk was returned to its first position.

Machines and Mechanical Devices.

AUTOMATIC ADJUSTABLE REEL.—C. H. COON, Saugerties, N. Y. The aim of the inventor is to produce a reel in which the virtual diameter remains sufficiently constant. In other words, the diameter of the reel reduces itself automatically as the web of the material wraps upon it. In this way the length of material wrapped upon the reel in one revolution remains constant, and when the material on the full reel is cut, the sheets will all have the same length.

COUNTERBALANCE FOR WATER-PUMPS.—W. KOETHE, JR., Brinkman Ridge, Wis. The purpose of this invention is to provide a construction for a counterbalance that is an attachment for a water pump, which will balance the weight of the pump rod and the bucket on it, and of water lifted by the rod and bucket on it, and of water lifted by the rod and bucket, thus reducing labor in operating a pump having the improvement.

STEAM RENDERING-TANK AND PRESS.—C. H. STADLER, New York, N. Y. The objects here are, first, to provide a tank for cooking materials out of which grease, oils, etc., are rendered, under steam pressure; second, to draw off the grease, oils, etc., after the materials have been cooked; third, to drain the water and remaining grease from the materials left in the tank; fourth, to press the materials for the removal of any still remaining oil, grease, water, etc.

Prime Movers and Their Accessories.

ROTARY ENGINE.—W. G. SHEPPARD, Indianola, Neb. The device consists, generally speaking, of a rotor having a vane fixed thereon, a fulcrum valve, means for letting a motive fluid in between said fulcrum valve and said vane on either side thereof, and means for exhausting the motive fluid from between the fulcrum valve and the vane.

INTERNAL-COMBUSTION ENGINE.—F. REAUGH, Oak Cliff, Texas. The invention resides in a peculiar arrangement of a plurality of cylinders in conjunction with a single main or engine shaft, with which shaft one or all of the cylinders may be connected independently and at will, thus enabling the main shaft to be driven from the operation of a single cylinder while the other cylinder or cylinders, with all of their immediately allied parts, remain absolutely inactive.

Railways and Their Accessories.

RAILROAD-TIE.—J. S. MILLER, Clinton, Neb. Mr. Miller's invention has for its purpose the provison of a concrete tie on which the rails may be supported, the tie being so constructed that it is reinforced by the means provided for securing the rails. Also the provision of means in connection with the reinforcing members for spacing the ties apart at a predetermined distance from each other.

Pertaining to Recreation.

BOWLING-CABINET.—R. H. MULFORD, Connellsville, Pa. This cabinet is especially adapted to be used as part of the furniture of a bowling alley. The object is to produce a cabinet which will constitute a bench upon which the players or spectators may seat themselves, and which has a special construction enabling the cabinet to hold the bowling pins, the bowling balls, and also the hats and coats of the players.

PYROTECHNICAL BUTTON.—A. JEDEL, New York, N. Y. A special object of this invention is to provide a trick or joke device, which may be secured on the person, and which when ignited, produces a startling or unexpected effect. Means provide for safely and securely holding the compound, so that it may be worn and ignited, while on the person without liability of personal injury.

GAME APPARATUS.—C. F. DOERR, Yonkers, N. Y. The invention pertains to parlor games, and its aim is to provide an improved game apparatus, more especially designed for playing baseball, and arranged to afford amusement to the players and onlookers and to require considerable skill on the part of players to successfully play the game.

MUTOSCOPE.—A. S. FERGUSON, Springfield, Mo. The invention is adapted for use as a toy or parlor amusement, the same consisting essentially of a series of photos or other pictures arranged radially in a circle, thus forming what may be termed a picture-wheel, which being rotated, the pictures are successively turned back and thus exhibited to the onlooker.

Pertaining to Vehicles.

GASOLENE-FEED.—A. W. HOFACKER, Bottineau, N. D. The object here is to provide a means for insuring a constant supply of liquid fluid to the carbureter of a power driven vehicle, regardless of the inclination of the body of the same as when hill climbing. In vehicles having the engine in front, and the fuel tank beneath the seat, the carbureter will not get a sufficient supply of fuel when the front of the vehicle is elevated, as in hill-climbing, especially if the fuel supply is low.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

MANUAL OF PHYSICAL GEOGRAPHY. By Frederick Valentine Emerson, Ph.D. New York: The Macmillan Company, 1909. 8vo.; 291 pp. Price, $1.40.

The exercises in this manual have for the most part emanated from the author's classroom experiences. There is presented a variety of exercises, some of them advanced in character that will cover topics capable of laboratory illustration usually presented in a course in physical geography. Some of the questions are practical. For instance, let us take up the subject of fog. Here are a few of the questions. What is fog? What is its general cause? Where have you seen it occur? If over land or water, what is the apparent cause? How dense is it? Does it disappear suddenly or slowly? Did you see the fog around a piece of ice or a water pitcher on a hot day? What effect has fog on bodily sensations? What in economics? The fogs of London. The book is especially valuable to advanced students.

PRACTICAL ENGINEER POCKET BOOK for 1910. London: The Technical Publishing Company, Ltd. 16mo.; 684 pp. Cloth, price 1s. net; leather, gilt, with diary or ruled section paper, 1s. 6d. net; postage 3d. extra. Price, 60 cents.

We have reviewed various editions of this book for a number of years and have found that the information conveyed was reliable and is presented in such form as to be very readily available. The excellent indexes are to be particularly commended.

ETHER OF SPACE. By Sir Oliver Lodge, F.R.S. 16mo.; 168 pp.

Sir Oliver Lodge needs no introduction to the readers of this paper. He is well known as an exponent of the ultra-modern physical theory with which the English school of physicists have been identified. In this book he explains in a simple way the necessary conception of an ether and formulates theories which, although some of them have not yet gained current acceptance, will undoubtedly do so in time.

THE WATER SUPPLY, SEWERAGE, AND PLUMBING OF MODERN CITY BUILDINGS. By William Paul Gerhard, C.E. New York: John Wiley & Sons. London: Chapman & Hall, Ltd., 1910. 8vo.; 493 pp. Price, $4.

The present work is an extremely valuable one. The engineering problems connected with the modern city building are very complicated. The chapters, while correlated to each other, are purposely so written that each one is complete in itself and each one may be read or studied without reference to the others. The book is splendidly illustrated by means of helpful diagrams and half tones. The titles of the chapters are as follows: Essential Features of the Hydraulic and Sanitary Engineering of Buildings. Sanitary Fixtures and Appliances. Advanced and Simplified Plumbing. Plumbing in its Relation to Disease and Municipal Control of Plumbing. Domestic Water Supply. The Water Supply of Large Modern City Buildings. The Maintenance of Pipe Systems for Sewage, Gas and Water. Rules on Plumbing, Water Supply and Sewerage, chiefly for Hospital Buildings and other Public Institutions. Mr. Gerhard has an international reputation as a sanitary engineer, and this book may be looked upon as authoritative.

AUTOMOBILE DRIVING SELF-TAUGHT. By Thomas H. Russell, M.E., LL.B. Chicago: The Charles C. Thompson Company, 1908. 12mo.; 222 pp. Price, $1.

As comfort and safety in automobiling depend to a very large extent upon the skill of the driver, it should be the aim of every one who intends to drive a car to acquire a knowledge of the approved methods of driving. It is the object of this book to present such information in a convenient practical manner so as to make it comparatively easy for any motorist to acquire skill in the management and care of his machine. Study and practice combined will surely develop the expertness which is needed nowadays at the wheel, being demanded alike by the interests of the automobilist and of the non-motoring public. The careless or ignorant driver is a menace not only to the safety of the public, but also to that of his passengers. The daily experience of every motorist demonstrates the need of carefulness in driving, and there is no longer any excuse for ignorance. The methods of driving are described in this work and those which have been found best in actual experience on the road. From these pages the motorist can learn how to start, drive and manage his car under all conceivable circumstances. Those methods of caring for the car when not in use are also plainly shown as well as the manner in which a car should be laid up when necessary. The book appears to be a most practical one.

CONCRETE. By John C. Trautwine, Jr., and John C. Trautwine, Third, Civil Engineers. New York: John Wiley & Sons, 1909. 16mo. Price, $2 net.

Trautwine's Civil Engineer's Pocketbook is too well known to need any praise at our hands. The nineteenth edition of 1909 completed the hundredth thousandth copy, which is a phenomenal sale for a scientific and technical book. In fact, we believe this is the largest sale on record for any such book. The most notable of the new features in this new edition is a series of articles on concrete, plain, reinforced, natural cement, sand and water. Practically all this matter, occupying about 200 pages, is entirely new as far as its publication is concerned. For the convenience of many engineers the section on concrete has been reprinted in the form of a handy volume which should be in the hands of all engineers. Typographically, the book is perfect for an engineer's pocketbook. The high professional standing of the engineers who have compiled the book is sufficient guarantee of its accuracy.

RADFORD'S COMBINED HOUSE AND BARN PLAN BOOK. Edited by William A. Radford. New York and Chicago: The Radford Architectural Company, 1908. 4to.; 287 pp. Price, $1.

The volume before us is a most practical one, giving designs for barns, livery stables, grain barns, dairies, cow barns, feed lofts, cattle sheds, poultry houses, implement sheds, vehicle sheds, hog houses, corn cribs, smokehouses, granaries, tank houses, etc. The illustrations serve the purpose, although they are rather coarse. Prices for blue prints, which would enable any one to build these barns, are listed.

PRACTICAL ENGINEER ELECTRICAL POCKET BOOK AND DIARY for 1910. London: Technical Publishing Company, Ltd. 16mo.; 570 pp. Price, cloth, 1s. net; leather, gilt, 1s. 6d. net; postage 2d. extra.

This welcome annual visitor contains as usual valuable statistics, data, rules, tables, formulae, etc., and should be in the hands of all who are interested in electrical matters.

PROBLEMS IN WOOD TURNING. By Fred D. Crawshaw, B.S., M.E. Peoria, Ill.: The Manual Arts Press, 1909. 12mo. Price, 80 cents.

Wood turning is considerable of an art, requiring quite a little knack of handling the tools. The present work is an extremely practical one, and the illustrations are the best we have ever seen in a book on wood turning. The various projects are admirably worked out.

HANDBUCH FÜR HEER UND FLOTTE. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete, herausgeben von Georg von Alten, Generalleutnant z. D., unter Mitwirkung von mehr als 200 der bedeutendsten Fachautoritäten. Complete in 108 instalments. Price per instalment, 50 cents. Berlin, Leipzig, Vienna and Stuttgart: Deutsches Verlagshaus Bong & Co.

The first three instalments of the second volume of this remarkable military and naval encyclopedia lie before us. The instalments extend from "Bayreuth" to "Beurkundung." In the care which has been taken in the individual articles these new instalments are well up to the standard of those which we have previously reviewed. Of particular interest are the articles on benzine and benzol. The essay on Belgium may well be regarded as a model of good military writing, for it discusses clearly and masterfully the military geography, history and military system of a small but important European body politic.

POWER, HEATING AND VENTILATION. A Treatise for Designing and Constructing Engineers, Architects and Students. By Charles L. Hubbard, B.S., M.E. Part II., Power and Lighting. First edition. Brattleboro, Vt.: The Technical Press, 1909. 8vo.; pp. 397. Price, $2.

The author has produced a thoroughly practical book which will be warmly welcomed by all engineers who have charge of power and lighting plants. There is always room for a good book on this subject and the author has certainly produced a most admirable treatise which is worthy of a large sale.

POWER, HEATING AND VENTILATION. A Treatise for Designing and Constructing Engineers, Architects and Students. By Charles L. Hubbard, B.S., M.E. Part III., Heating and Ventilation. First edition. Brattleboro, Vt.: The Technical Press, 1909. 8vo.; pp. 647. Price, $2.

This is a very practical book dealing with all phases of warming and ventilation. Even such subjects as electrical heating are taken up. The illustrations are excellent, the expensive, but eminently successful wax process being used. The tables are also of great value. The subject is treated with rare discrimination, and the book cannot help but be of great use to all engineers.

ROMANTIC GERMANY. By Robert Haven Schauffler. New York: The Century Company, 1909. 397 pp. Price, $3.50 net.

The beautiful book with a charming cover so suggestive of old Germany is a delightful one. The plates are charming and they are beautifully reproduced in various tints and colors. The cities which are discussed are Danzig, Berlin, Potsdam, Brunswick, Goslar, Hildesheim, Leipsic, Meissen, Dresden, Munich, Augsburg, and Rothenburg—certainly a galaxy of names to conjure with. It has been a long time since a good book has been produced on Germany which

deals with the land itself and not with its politics, history, sociology, commerce and science. Indeed the would-be visitor has to look back to "Views Afoot" written by young Bayard Taylor in the year 1846. To those who have left the beaten track Germany still remains the land of the Nibelungenlied and of Grimm's Fairy Tales, of gnomes and giants, storks and turreted ring-walls, of Gothic houses in rows, and the glamor of medieval courtyards. Many of these towns have preserved almost intact their old-world magic, and a touch of real romance is to be found as well as in almost every one of the larger cities noted above which we have been taught to consider hopelessly prosaic. It is hoped that the present volume will lure the traveler from his hard beaten track in France, Switzerland and Italy to the fresh regions of Romantic Germany.

Simplified Mechanical Perspective. By Frank Forrest Frederick. Peoria, Ill.: The Manual Arts Press, 1908-1909. 8vo.; 54 pp. Price, 75 cents.

This is a treatise for the use of high schools, technical and manual training high schools, evening and industrial schools, and all schools. The author has used the methods outlined for more than twenty years, and he states that he has never had a student learn much about the subject unless he carefully worked each problem and thoroughly understood it before attempting the next. The problems are admirable and a thorough mastering of this work will give any one an excellent idea of perspective.

The Design and Equipment of Small Chemical Laboratories. By Richard K. Meade, B.S. Chicago: The Chemical Engineer Publishing Company, 1908. 12mo.; 136 pp. Price, $2.

It very often happens that the young chemist, perhaps fresh from college, is called upon to design and equip a laboratory when his knowledge of how it is to be done is rather meager. The experienced chemist confronted with the task can usually bring to bear upon the subject sufficient practical knowledge gained from other laboratories in which he has worked to arrange and equip a laboratory which will meet fully his requirements and can do so in many instances better than any body else can do it for him. Many things which are done in the college laboratory are impossible in the private laboratory, where means are limited; for instance, ventilation of the hoods, gas supply may be non-existent, etc. To these young chemists the suggestions in this book on the design and equipment of small laboratories are made. But even experienced chemists may gain valuable points from it. There is an extremely small amount of literature on this subject, so that a thoroughly practical book like this should be warmly welcomed.

Nutrition and Dietetics. By Winfield S. Hall, Ph.D., M.D. New York and London: D. Appleton & Co., 1910. 8vo.; 315 pp.

This is a valuable manual for students of medicine, for trained nurses, and for dietetists in hospitals and other institutions. During more than ten years the author has been presenting the subject of nutrition to classes of undergraduates in medicine and to the nurses of two of the large city hospitals. There has been a repeated request for a concise text book suitable not only for under-graduates and nurses, but also for the general practitioner, and covering the whole field of dietetics; but no such book seemed available. The one thing which is notable in this volume is the absence of receipts. These are hardly necessary as the doctor does not require them and the nurses already have them in other forms. The book is a very excellent one, including a classification of diets. The book is printed in a good size type and is well bound.

Modern Lettering, Artistic and Practical. By William Heyny. New York: William T. Comstock, 1909. 8vo.; 136 pp. Price, $2.

This is a book of instruction primarily valuable in the hands of the beginner and of assistance to the experienced workman. "Modern Lettering" essays the subject from the practical standpoint from cover to cover. The author, a man of experience and of artistic temperament, boldly sets forta his ideas and propounds his methods in concise language. Directions even to minute details are given, all of which are valuable to the student. The plates are all on a large scale and the letters are clear and sharp. The French Roman is a new letter in this country and will be appreciated for its refinement, beauty and legibility. Much valuable information, the fruit of the author's long experience, is given on the choice of alphabets, the arrangement of words, and the spacing of letters, with good criticism of faults of modern letterers.

In a Yorkshire Garden. By Reginald Farrer. London. Edward Arnold, 1909 8vo.; 316 pp.

The author is very much in love with his subject. He has already written "My Rock Garden," "Alpine and Bog Plants," as well as other works. The present volume deals with "The Dreadful Dawn."

Natural Salvation (Salvation by Science). By Charles Asbury Stephens, M.D. Norway Lake, Me.: The Laboratory, 1910. 8vo.; 157 pp.

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graph is being taken. A careful observer with such an accurate instrument will obtain the spectrum of the star in the middle of the photograph flanked on either side by the spectrum of the metal iron or titanium or the gas hydrogen, placed there by the use of the electric current and induction coil. Astronomers use different metals for the purpose of comparison; the Yerkes Observatory, for instance, employs both iron and titanium on the same plate.

A good photographic spectrum will then consist of that of the star to be investigated, supplemented by the lines of the comparison spectrum. How are these spectrograms to be interpreted? And how can they tell us anything about stellar motions? Remembering that light is a wave motion, we have a simple analogy in the case of sound, and one with which everyone is familiar. In traveling in an express train which passes another going in the opposite direction, we have all of us noticed that the pitch or tone of the whistle or bell of the other engine suddenly drops as it passes by us. The reason is that sound is also a wave motion (though the waves are much different from those which cause light) and the quickly approaching engine causes more waves to crowd into our ears each second of time than it does when the engines are not moving. As the tone is determined by the number of waves which fall on the ear drum every second, the consequence is that the pitch of the whistle or bell is raised while the two trains are approaching, and for the same reason it is lowered when the two after passing are going away from each other. The change in the tone of the whistle depends on the speed of the two trains and also on the velocity of sound, and as these are comparable, a decided change in tone is readily noticed.

Applying the same ideas to light we have what is known in science as the Doppler principle of motion in the line of sight. A vast number of waves of light impinge on the retina of the eye in every second and excite in the rods and cores the sensation which our brain interprets as light. If the light is red, then four hundred millions of millions of waves (4×10^{14}) enter the eye every second; if the light produced is violet, about twice that number. In spite of the fact that these vast numbers of waves come into the eye so quickly, if the source of light toward which we are looking is moving toward us, then as a result more waves are crowded into the eye in each second; and if the body is moving away from us fewer than the normal amount come into the eye. Evidently the shift from the normal is excessively small, but even so, it is a measurable quantity for the astronomer with his methods of precision. A shift toward the violet means that the waves are crowded together and the star is approaching the earth, a shift toward the rear end of the spectrum signifies that star and earth are separating from each other. A measure of the shift gives the velocity of the star in miles per second.

The calculation of these velocities in the line of sight is now a great, fruitful field of astronomical research and many important developments have been made in it. It is a far cry from the small spectroscope that is ordinarily used in a physical laboratory to the magnificent Yerkes telescope and its refined spectrograph (Scientific American, December 25th, 1909). This required not only vast improvements in the instruments themselves but in methods all through as well. The refinements of present day work are due more to Prof. W. W. Campbell, director of the Lick Observatory, than to any other man. He has been a leader in all plans of spectroscopic work, and his methods are largely followed wherever such researches are attempted.

To the uninitiated the photograph of a stellar spectrum shows remarkably little. Even with the great 40-inch Yerkes

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lens a photographic plate 1 2/3 x 4 inches only is used, and in the center of this are some faint streaks of light about two inches long and possibly one-sixteenth of an inch in width. This tells the whole story of the star's motion. Naturally this photograph is placed under the microscope for examination and there it appears magnified and is measured. The physical constitution of the star, the metals that compose it, is known from the lines of the stellar spectrum, hydrogen for instance showing its badge by a series of prominent lines. The motion of the star is shown by the placing of these lines, whether they are shifted from their normal position, as given by the comparison spectrum, to the violet or toward the red end of the spectrum. If there is hydrogen in the star, then the lines of the hydrogen comparison spectrum give the position of rest or zero velocity with respect to the earth, and the amount of the shift measured under the microscope gives the motion of the star. If there are other lines in the spectrum of the star (as is usually the case) we can readily in an analogous fashion measure the motion. The photographs in the illustration were taken at the Yerkes Observatory with the great 40-inch telescope. Two separate spectra are there shown, taken but three days apart on January 5th and 8th, 1906. The star spectrum appears in each between the comparison spectrum of titanium, and it is widened to make the lines more prominent, and the whole greatly enlarged. The violet end is toward the left, red end to the right. Portions of the comparison spectra on both are cut away to bring the two closer. The numbers on the top give the wave-lengths. Notice that all the lines in the lower spectrum are shifted much more to the right with respect to the comparison lines than in the upper spectrum. This is specially noticeable at line 4501, and better still at 4481. A measure of the amount of these shifts gives the radial velocity of the star with respect to the earth. The variable velocity in the line of sight of this star shows it is not a single star but a system. Measures made by the writer on the star β Trianguli show the following results where the radial velocities are given in miles per second relative to the sun. The plus sign means that the star is increasing its distance from the sun, and a minus sign that it is moving toward the sun:

Date.		Velocity in line of sight.
1908—Sept.	7	+ 33 miles per second
Sept.	8	+ 31 miles per second
Sept.	18	— 5 miles per second
Oct.	5	+ 1 mile per second
Oct.	12	+ 20 miles per second
Nov.	8	+ 18 miles per second

The measures must be carried out with utmost care. If the spectrum of the star is good with many well defined lines, the radial velocity (i. e., toward or away from us) may be determined to an accuracy of one-tenth of a mile per second. Think of this when light travels at the rate of 186,000 miles per second, when six hundred millions of millions of waves enter the spectroscope every second, and when in addition the star is so far distant that its light even when traveling at such enormous velocities might take hundreds or thousands of years to reach us! To contemplate it makes our minds whirl at the enormity of space, and causes us to bow down in reverence to the wonderful human intellect that can solve such problems!

Investigations of certain stars show us that at one time it may be moving toward our sun, once in a few days or weeks the direction of motion may be reversed and it is traveling away from the sun. The star of itself is unable to change its motion, and another body must be present, so that variable velocities in the line of sight as in β Trianguli denote that two or more suns are present in a system and they are in revolution about each other. At our distance from the stars the

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Lathe, Z. B. Coes	948,467
Lathe, automatic, J. P. Brophy	948,690
Lawn cleaner rake, rotary, C. H. Mosher	948,820
Leather, artificial, J. J. C. Smith	948,383
Letter box, L. Ehrlich	948,815
Level, spirit, E. Anderson	948,570
Lifting jack, J. E. Morse	948,517
Lifting jack, G. R. Booth	948,843
Lightning arrester, B. E. Clarkson	948,873
Link mesh, machine for making, A. C. Pratt	948,615
Linoleum, manufacturing, P. Blaubach	948,572
Liquid dispensing appliance, I. W. Hughes	948,883
Liquid into vessels through closed chambers of filling machines, means for introducing, J. M. Hicks	948,762
Liquds or semiliquids, apparatus for purifying, N. H. Freeman	948,725
Litter carrier, Schemmel & Besler	948,554
Lock. See Ball bearing lock.	
Locker, metal, R. W. Jefferis	948,628
Locking device, F. D. Winterling	948,804
Loom for weaving, shuttleless, E. Smith	948,945
Loom, haircloth, G. S. Cox	948,370
Loom shuttle, haircloth, G. S. Cox	948,415
Loom, weft replenishing, H. Wyman	948,568
Magnetic separation, apparatus for electrostatic, H. M. Sutton et al	948,599
Mail bag catcher and deliverer, J. Wood	948,778
Mail bag lock, S. Fehnel	948,543
Mail bag or the like lock, C. Sismondi	948,555
Mail marking machine, T. G. Stoddard	948,712
Mailing tube, G. D. Horton	948,506
Mangle, P. L. Brockardt	948,587
Manure loader, W. Roberts	948,552
Marking gage, W. E. Perkins	948,523
Match box, R. E. Jones	948,884
Match receptacle, H. Wark	948,803
Matrix forming machine, G. S. Williamson	948,677
Mattress, A. Bjornstad	948,644
Mattress cover, E. L. Fuller	948,684
Measuring the flow of liquids, apparatus for, C. J. Clark	948,872
Mechanical movement, H. C. Gammeter	948,782
Medicaments, preparing, A. Meyer	948,930
Menu cards, newspapers, and other articles, support for, Darche & Schwer	948,955
Metal, electrolytic separation of, Chance & Kent	948,681
Metal, expanded, N. E. Clark	948,414
Milk cooler, J. S. McNeel, Jr.	948,960
Milking apparatus, cow, F. M. Berberich	948,440
Milking machine, Wawrinsky & Aibihn	948,360
Milking machine, B. J. Bigelow	948,841
Milking machine teat cup, Hodge & Andersen	948,608
Milling spirals, machine for, B. M. W. Hanson	948,696
Miter box, N. G. Nelson	948,428
Mold. See Briquet mold.	
Mold for plastic bodies, W. H. Crum	948,475
Molding flask, C. D. Smith	948,528
Molding machine counterbalance, E. M. Huggins	948,975
Mop head, E. H. Fenton	948,315
Motor controller, automatic, A. E. Handy	948,560
Motor controlling device, electric, F. A. Hayes	948,574
Mouse trap, G. O. Terry	948,908
Mower, C. Larson	948,333
Music leaf turner, P. Kohn	948,511
Music roll for mechanical musical instruments, H. P. Ball	948,806
Musical instrument, self-playing, B. L. Cartmell	948,474
Nail making machine, Hart & Dobson	948,879
Napkin holder, H. H. Frick	948,576
Net lifting machine, self-clearing gill, J. Gierke	948,760
Net making machine, C. Zang	948,386
Nipple threading mechanism, H. W. Oster	948,793
Nut lock, C. J. Tomlinson	948,357
Nut lock, S. Harvey	948,855
Nut lock for rail joints, J. J. O'Donnell	948,823
Nuts, manufacturing thumb, R. H. Smith	948,616
Office equipment, F. Stevenson	948,531
Oil burner, W. H. Creswell	948,921
Oil cake envelop or press cloth, N. W. L. Brown	948,409
Onion pulling attachment, F. A. Zappe	948,715
Operating table, E. E. Helfrich	948,447
Ore pulp treating apparatus, B. MacDonald	948,766
Ores for the extraction of metals therefrom, treatment of, H. Rosalt	948,827
Oscillations, apparatus for producing high frequency, I. Schonberg	948,348
Overshoe, J. Smith	948,797
Oxids of nitrogen from the air, producing, F. I. Du Pont	948,372
Package, J. S. Ferguson	948,503
Package, J. H. Boye	948,645
Packing ring, McQuay & Norris	948,518
Packing, rod, Johnston & Finley	948,610
Paddle, J. Hary	948,856
Padlock, pneumatic, F. J. Gilroy	948,853
Paint and varnish remover, M. Daxe	948,814
Paper bags or the like, rack for, J. J. Caylor	948,604
Paper folding machine, A. B. Colton et al.	948,920
Paper or similar fabric in web form, manipulating, Knapp & Pancoast	948,549
Paper weight and fan, combined, J. Keith	948,611
Parer and corer, combined vegetable, A. Chase	948,573

(*Concluded from page 171.*)

sideways displacement is not of sufficient magnitude to make the stars appear separately, and hence we have a comparatively new class of stars, those which appear as single even in the most powerful telescopes, but whose motions in the spectroscope show that they are really double suns. These are called spectroscopic binaries. Recent researches at the Lick Observatory, Yerkes Observatory and other places bring to our knowledge most startling results. Imagine two suns each many times more massive than our own, rapidly revolving about each other in a few hours! In addition to this comes the fact that at least one in every few stars so far investigated turns out to be not a single star but a system, and it has become necessary to reconstruct our ideas regarding the importance in the universe of this small ball which we call Mother Earth.

Dying Pearls.

(*Concluded from page 162.*)

chill which can very easily cause its tender outer layers to contract and its beautiful luster to disappear. Unfortunately the Thiers collar has been laid on red velvet, and this circumstance, too, can help to dull its shimmering surfaces day by day, for the color also, produced by chemical means, exercises a slow but sure influence. Besides it lies too near a window, and so the rays of light, too, have an injurious effect on it. The directors of the Museum of the Louvre have long deemed the collar one of their most precious curiosities; but now, in consequence of the evident steady diminution of its value, they would like to sell it and with the money obtained for it procure a few more good paintings. Permission therefor, however, is refused by the executrix and chief heiress of the Thiers estate, and consequently the jewelers of Paris consider the collar an object of experiment by which it will be shown in how many years a pearl can "die away" when nothing is done for its preservation. How long pearls "live," that is, how long they keep their luster, has not yet been ascertained, but, as many instances, especially in the successive inheritance of heirlooms, prove, some preserve their freshness through centuries in consequence of the habitual gentle treatment they receive. When treated thoughtlessly a pearl dies quickly.

Life Insurance and the Moral Responsibility of Employers.

BY DARWIN P. KINGSLEY.

The growth of life insurance and the development of a deep sense of responsibility on the part of employers of labor toward their employees are contemporaneous and kindred phenomena. They represent a better knowledge of the value of human life and a recognition of the increasing demand now fairly made on the controlling forces of society, by age and industrial misfortune, as well as by infancy, congenital incapacity, and weakness.

The middle-aged and the socially inefficient now form a relatively larger section of society than ever before. There are two reasons for this. The first is, that while there may not be as many children born now as formerly, among certain people, of the number born a much larger portion reach maturity. In other words, the ratio of adults to a given number of births has increased. The second reason is that modern business methods and the modern corporation, especially the manufacturing corporation, have created new conditions and complications. They have added to those who join the dependent classes under a simpler life, those who become dependent because their active lives have been devoted to highly specialized work.

Highly specialized labor is constantly menaced by loss of occupation, and this menace increases as the age of the worker advances. Under the fierce competition

(*Continued on page 173.*)

Pasteurizing apparatus, Cauffman & Best... 948,443
Paving block, composite, E. H. Benners.... 948,808
Pen, foldable and portable stock, W. C. Smith ... 948,351
Pen, stylographic, L. Trotsky ... 948,832
Pens and pencils, retainer for fountain, L. D. Van Valkenburg ... 948,802
Penholder, J. M. Geiger ... 948,852
Penholder, R. B. Ward ... 948,910
Pencil, C. von Schemnitzky ... 948,535
Petticoats, flounce for, D. J. McKenna ... 948,821
Phonograph, W. H. Hoschke ... 948,327
Phonograph, C. M. Hughes ... 948,328
Phonograph, P. M. Ravenskilde ... 948,675
Photographic prints, etc., device for use in connection with the dry mounting of, G. W. Morgan ... 948,867
Piano, Danquard & Pfannstiehl ... 948,391
Piano, keyless, T. P. Brown ... 948,984
Picture machines, adjusting mechanism for moving, W. N. Selig ... 948,654
Pile fabric and weaving the same, M. J. Whittall ... 948,384
Pin, F. M. Schwartz ... 948,775
Pipe. See Blowpipe.
Pipe, M. Rheinauer ... 948,550
Pipe, cigar holder, etc., J. R. Perry ... 948,634
Pipe coupling, train, R. M. Dixon ... 948,312
Pipe hanger, A. A. Noyes ... 948,902
Pipe joint filling device, F. J. Hatch ... 948,686
Pipe threading machine, E. A. Hoefer ... 948,394
Plant support, wire, O. A. Muller..948,671, 948,672
Plow, E. Rosenfeld ... 948,431
Plow attachment, C. W. Eschert ... 948,478
Plow attachment, L. H. McCall ... 948,614
Plow, hand, A. R. Corrington ... 948,847
Plow moldboard, rotary, A. Morison ... 948,457
Plumbing systems, test connection for, J. Kuhl ... 948,525
Pneumatic despatch tube system, F. H. Wolever ... 948,714
Polisher, J. E. Curtis ... 948,691
Post brace anchor, C. I. Stocking ... 948,532
Potato cleaning and assorting machine, J. A. Bittle ... 948,842
Poultry fountain, K. B. Martin ... 948,928
Powder magazine, Ervin & Keeton ... 948,923
Power transmission, J. G. P. Thomas ... 948,436
Printing presses, ribbon cutting attachment for, A. Livernoch ... 948,632
Projecting device, W. H. Munshaw ... 948,565
Pulley, driving, J. Mold ... 948,516
Pump for cleaning drain pipes, suction, L. O. Landgren ... 948,590
Pump for motor vehicles, tire, M. L. Bastian ... 948,807
Pumps or motors, packing for rotary, R. F. Trattner ... 948,534
Pumps, water regulator for jacketed, W. M. Austin ... 948,471
Punch and die mechanism, C. A. Lindholm.. 948,818
Punching machines, automatic attachment for withdrawing punchings from, Scott & Gale ... 948,382
Rail clip, O. M. Knox ... 948,375
Rail, guard, O. C. Simmons ... 948,597
Railway coupling, A. Lewis ... 948,765
Railway tie, H. M. Levinson ... 948,589
Railway tie and rail fastening, W. R. Gorrell ... 948,877
Railway tie rod, E. J. Bricker ... 948,496
Rake. See Lawn cleaner rake.
Rake cleaning attachment, hand, W. Bullard ... 948,497
Range, H. S. Marvin ... 948,943
Razor blade holder, C. W. Levalley ... 948,864
Razor stropping device, W. H. Nicholls ... 948,673
Record keeping device, A. H. Wheeler ... 948,676
Reeling and other textile machines, thread tightening device for, J. Schweiter ... 948,580
Refrigerator, F. L. Armstrong ... 948,464
Refrigerator, H. Bieder ... 948,756
Refrigerator, Haas & Mefford ... 948,880
Rein guide, W. Laudon ... 948,453
Reversing mechanism, G. W. Freeland ... 948,781
Ribbon fastener and sales index, D. H. Woodman ... 948,490
Riveting device, J. Tischler ... 948,980
Rotary engine, W. G. Dodd ... 948,692
Router bit, C. Schroepfer ... 948,904
Rubber rings, machine for cutting, W. P. McGeouch ... 948,401
Rupture appliance, Hogle & Meyer ... 948,627
Sad iron, Spahr & Stichler ... 948,773
Safe and vault protector, E. Menne ... 948,929
Salting device, automatic stock, F. & T. L. Pelfer ... 948,794
Sand drier, Jackson & Fleischbein ... 948,330
Sash fastener, A. Kissinger ... 948,588
Sash fastener, E. L. Brenner ... 948,918
Sash, window, G. J. Miller ... 948,515
Saw gage, crosscut, J. Morin ... 948,594
Saw gummer, C. A. Chandler ... 948,953
Scale, N. Nilson ... 948,705
Screen, R. M. Dixon ... 948,313
Screen, S. C. Schofield ... 948,433
Screw head turning and nicking machine, W. Avery ... 948,492
Screw lock, J. P. Hesse ... 948,326
Seal lock for receptacles, C. H. Johnson ... 948,783
Sectional bolt, E. Fongeallas ... 948,559
Seed huller, cotton oil mill, Kappler & Gaines ... 948,508
Separating, washing, and concentrating materials, A. W. H. Lenders ... 948,512
Separating, washing, and concentrating materials, apparatus for, A. H. Lenders.. 948,413
Sewer mold, T. E. Clark ... 948,539, 948,540
Sewing machine, M. G. & A. Rosenthal ... 948,345
Sewing machine embroidering or darning foot, W. C. Ellis ... 948,683
Sewing machine folding and trimming mechanism, D. Zelser ... 948,364
Shade holder, E. E. Brock ... 948,473
Shaper attachment, Kramer & Brown ... 948,784
Sharpener, cutlery, J. A. Wilkinson ... 948,362
Sharpener, tool, J. Noss ... 948,429
Sharpening device, lawn mower, C. C. Rayl. 948,962
Sharpening machine, razor, E. A. Conway.. 948,369
Sheet metal corrugating machine, J. J. Rigby ... 948,551
Ship detector, F. S. Long ... 948,424
Shipping case, interchangeable, N. J. Busby. 948,951
Shock loader, J. B. Schuman ... 948,380
Shoe, H. McMaster ... 948,338
Shoe vamp protective guard, Foley & Crowley ... 948,419
Shovel. See Cultivating shovel.
Sifter, O. G. Boggs ... 948,494
Sign, illuminated, R. E. Wiley et al ... 948,557
Signal system, line, H. D. Stroud ... 948,979
Signaling apparatus, G. Hughes ... 948,562
Signaling system and appliances, J. G. Nolen ... 948,738
Silo, R. J. & A. C. Klatt ... 948,397
Sintering furnace, G. G. Vivan ... 948,981
Skate, roller, Dodge & Alden ... 948,666
Sled, G. J. Mennenga ... 948,866
Sled brake, W. Nichols ... 948,651
Smelting apparatus, E. Fink ... 948,468
Soap dispensing machine, R. G. Clark ... 948,721
Sound records and other objects, composition for, J. C. English ... 948,314
Speed and reverse drive mechanism, change, A. C. Pletz ... 948,825
Spinning machine, doffer guard, R. S. Matteson ... 948,650
Spool, C. Omellah ... 948,430
Spotting machine, H. S. Kemp ... 948,509
Spring fork, M. Schenck ... 948,743
Spring support, A. G. Bodenstein ... 948,493
Sprocket wheel, W. W. Willson ... 948,385
Squeegee or window cleaner, J. R. Lane ... 948,630
Stalk cutter, W. R. Lemons ... 948,423
Stalk cutter and cart, combined, J. T. Graves ... 948,854
Stamp holder, multiple self-inking, V. W. Boller ... 948,811
Staple forming and discharging mechanism, V. Hoxie ... 948,448, 948,699
Staple or clip, F. J. Yetter ... 948,913
Steam boiler, T. Barrow ... 948,366
Steam boiler, tubular, S. Elliott ... 948,373
Steel, soaking pit for manufacture of, Myers & Dill ... 948,932
Stereotype matrices, apparatus for producing, H. Winter ... 948,655
Stiffener, garment, L. B. Laridon ... 948,958
Stool or table, foldable, H. J. Swarts ... 948,533
Stove flue, E. E. Thompson ... 948,747
Stove, vapor, E. A. Gutermann ... 948,393
Stovepipe collar and anchor, E. E. Youtz.. 948,602
Stovepipe holder, L. A. & W. J. Shaw ... 948,937

(*Continued from page 172.*)

which governs the greater portion of our industrial life, new processes, new methods, short cuts, labor-saving devices, new inventions, are all eagerly sought by the employer of labor. Some of these are revolutionary in their effects. They call for a readjustment of the whole plant. When that readjustment comes, the older men are invariably dropped. In short, the avenues which lead to employment, for all highly specialized labor, are practically open now only to youth. The middle-aged man enters with difficulty, and the man past middle life substantially cannot enter at all. The man who did many things, none of them highly specialized, from twenty to sixty-five, is likely never to become entirely dependent upon society. The man who did some highly specialized piece of work which involved only a part of some specific thing, or even a part of a part, may be forced into the dependent class before he reaches old age, and when he joins that class he is much more helpless than the man who has done many things. It is probable that the specialist, altough he labored fewer years, rendered society the more valuable service of the two, and that therefore he has, morally at least, a clearer title to consideration. But however that may be, he is the inevitable product of the whole plan of society and business, and the obligation of the man who employs him, and the interest of general society in what finally becomes of him, are clear and unavoidable. That this class must be shown how to protect itself against the menace which it constantly faces or that it must be helped outright after disaster or age come, are compelling facts in the sociology of the times.

There can be no question that a system which teaches these people how to protect themselves against this menace, is more in harmony with the genius of our institutions than a system which coerces them into action or a system which finally places the burden of their support and care upon general society. It does not follow that a system which works well in Germany would work well here; or that a system which appeals to the needs of the people of Great Britain will answer here. There are distinct advantages in the German plan,—chiefly that it is compulsory and that the laborer is forced to make provision for certain benefits even though he may have no very intelligent understanding of the wisdom of the plan or its effects on society. There is a difference between the compulsion of government, which tells the workingman that certain things must be done, and the proposition of a corporation which tells a man what the conditions of his hiring are.

If the conditions named by the employer involve some system of life insurance, some system of deferred annuities, a man can study the question and take a position or leave it alone because it recommends itself to his judgment or otherwise. This is a slower process than the German method, and probably for a good many years will be more expensive; but it seems to me to be in harmony with our notions of individual responsibility and the rights as well as the obligations of American citizenship.

The efficient employee, in specialized labor, has a fair claim to something beyond the returns contained in the ordinary contract of hiring. This right may be strengthened and its realization advanced, but it cannot directly be met, in this country, by governmental action. The capable worker deserves and should demand a programme of hiring under which he shall be entitled—and entitled by contract, not by the grace of his employer—to certain protection for his family if he dies prematurely, and to certain protection for himself if in the vicissitudes of industrial war he is shelved and wholly or in part compelled to join the dependent class.

There are sound reasons why corpor-

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Strainer, E. V. Hax	948,421
Strainer, J. C. McKim	948,900
Strainer, sink, Cody & Koors	948,954
Strainer, water, G. W. Collin	948,311
Strap joint, J. H. Skidmore	948,350
Stud or block, antislipping, T. Sloper	948,435
Subway, G. W. Jackson	948,451
Sulky, H. J. Miller	948,767
Superheater, H. W. Jacobs	948,331
Surgical clip applier, A. Le Witt	948,456
Switch. See Electric switch.	
Switch box or casing, Ziegler & Woodburn	948,438
Switch thrower, automatic, E. McNeil	948,427
Table having hinged leaf, A. Hendricks	948,729
Table leveler, F. K. Sheppard	948,708
Tag forming and affixing machines, tape feeding mechanism for, D. P. Moore	948,944
Tape applying machine, M. B. Diskin	948,575
Tapper, beer, W. W. Frisholm	948,647
Target trap, W. J. Clow	948,499
Taximeter, A. J.-B. E. Darris	948,371
Telephone call system, W. E. Zabst	948,941
Telephone pay station box, C. A. Anderson	948,753
Telephone transmitter, wireless, A. A. Jahnke	948,609
Terminal clamp, H. F. Richter	948,596
Thread cutting tool, J. B. Phillips	948,706
Tile molding machine, Costello & Houston	948,682
Tiles, etc., apparatus for decorating, Meyer & Young	948,931
Time controlling mechanism, A. W. Bailey	948,718
Tin from tin plate waste, apparatus for extracting, H. Brandenburg	948,679
Tire air pressure gage, W. E. Sandham	948,526
Tire, pneumatic, Kitchen & Storey	948,701
Tire, pneumatic, W. Odell	948,963
Tire setter, W. Schau	948,637
Tire tightener or tire setter, W. Schau	948,638
Tire, vehicle wheel, J. Cairns	948,389
Tires, core for manufacturing pneumatic, J. K. Williams	948,489
Tobacco pipe, J. R. Perry	948,635
Tool holder, B. M. W. Hanson	948,698
Toy, educational, H. B. Palmer	948,633
Track brace, A. J. Coover	948,390
Train stopping and signal actuating mechanism, J. F. Webb, Jr.	948,361
Transferring apparatus, material, L. Callahan	948,719
Tree protector, T. J. McNamara	948,339
Trolley wires and the like, suspension device for, G. A. Mead	948,789
Trousers stretcher, R. B. Liddle	948,734
Trousers stretcher and presser, W. V. Lane	948,895
Truck, casket, J. Pfeifer	948,482
Truck, hand, J. Buckley	948,964
Trunk, Kallis & Berg	948,783
Truss, hernial, J. Bunker ....948,305 to	948,307
Tube. See Mailing tube.	
Tubes, manufacture of, M. Peters	948,961
Tug, thill, W. J. Campbell	948,780
Turbine, G. A. Boddy	948,916
Turn table, H. R. Stickney	948,352
Twine cutter, H. I. Mattson	948,898
Type casting machine, W. N. Clements	948,605
Typewriter, B. L. Cary (now by marriage B. L. Bloodworth)	948,952
Typewriter escapement mechanism, F. S. Rose	948,553
Typewriting machine, H. S. McCormack	948,481
Typewriting machine, A. W. Steiger	948,486
Typewriting machine, McLaughlin & Beber	948,668
Typewriting machine, J. C. McLaughlin	948,669
Typewriting machine, A. M. Stone	948,799
Typewriting machine, E. B. Hess...948,972,	948,974
Typewriting machine supporting frame, C. D. Rice	948,826
Undercutter support, W. J. Whitworth	948,836
Unicycle, A. G. Jackulvis	948,859
Valve, G. B. Kennington	948,452
Valve, C. W. A. Koelkebeck	948,649
Valve and operating means therefor, ball cock, Neal & Childress	948,519
Valve attachment, flush, W. F. Geiger	948,876
Valve clean out, boiler check, J. R. Martin	948,702
Valve for blending hot and cold fluids, S. G. Neal	948,520
Valve, gate, A. Watson	948,359
Valve gear, J. Irving	948,976
Valve mechanism, air operated electrically controlled, J. F. Webb, Jr......948,405,	948,406
Valve mechanism for air brake and train stopping systems, air operated electrically controlled, J. F. Webb, Jr.	948,404
Valve mechanism, non-return, C. E. Golden	948,445
Valve, pneumatic safety, F. Moyle	948,469
Valve, universal controlling, W. C. Arp et al	948,571
Vaporizing and mixing device, C. F. Preston	948,402
Vehicle brake, automatic, G. W. Fisher	948,418
Vehicle driving mechanism, J. F. Waite	948,749
Vehicle, motor, R. Fuller	948,317
Vehicle, motor, G. W. Perry, Jr.	948,341
Vehicle washer, E. Muller	948,337
Vehicle wheel, E. S. Williamson	948,621
Vehicles, elastic suspension for, L. Basso	948,689
Vending apparatus, A. H. Arnold	948,914
Vending machine, J. H. Carroll	948,660
Vending machine, W. Asbury	948,838
Ventilating system, A. S. Johnson	948,629
Vessel closure, J. C. Schleicher	948,347
Voting mechanism, M. A. Dees	948,757
Wagon, dump, W. A. Underhill	948,358
Wagon seat lock, V. W. Heydlauff	948,505
Washboard, Ullrich & Weigert	948,909
Washboard clamp, J. E. Terhune	948,907
Washboiler, S. C. Logan	948,897
Washer. See Vehicle washer.	
Washer, J. B. Vannoy	948,600
Watch regulator, W. E. Porter	948,652
Water closet seat, auxiliary, J. G. Steffee	948,798
Water closet, etc., tank, G. H. Bailey, 948,657,	948,658
Water gage guard, D. Buissono	948,412
Water motor, L. L. Dodds	948,501
Water motor, current, H. B. Fenner	948,544
Water purifying apparatus, J. P. Lajoie	948,785
Water purifying apparatus, automatic circuit controller for, H. B. Hartman	948,648
Water supply, automatic device for controlling, J. A. Anderson	948,303
Water wheel, F. Bangerter	948,755
Web manipulating mechanism, Knapp & Pancoast	948,548
Welding apparatus, E. G. Budd	948,965
Welding, brazing, or soldering, electric, O. Kjellberg	948,764
Well cover, R. D. Hutning	948,329
Well drilling machine, G. D. Loomis	948,425
Wheel, T. Berntson	948,408
Wheel, R. R. Sandham	948,978
Wheel drive, magnetic traction, C. Scott	948,381
Wheel rim, removable, J. C. Cole	948,813
Whiffletree hook, J. M. Tappan	948,354
Whiffletree hook, P. H. Skavlen	948,527
Whip socket, Goldstein & Voigt	948,319
Winding machine, yarn, H. S. Golland	948,320
Window, H. J. Davison	948,956
Window cleaner, J. R. Lane	948,631
Window cleaner, H. L. Bailey	948,641
Window pane fastener, W. G. Kueter	948,957
Window screen, L. I. Brighton	948,844
Window ventilation, J. J. Best	948,779
Window ventilator and storm shield, R. A. Dunlap	948,417
Wire, means for applying coverings to, J. A. Heany	948,324
Wood in salt water, protecting, Tatro & Delius	948,355
Wrench, F. Knobel	948,332
Wrench, L. L. Barrick	948,870
Wrench, C. Wittman	948,946
Writing machine, E. B. Hess	948,973
Zinc from zinciferous materials, obtaining, H. Pape	948,740

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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tions should avail themselves in this work of the highly developed system of insurance and annuities presented by the responsible insurance institutions of this and of other States. Any effective system if established by corporations independently, will be based on the principles and methods used by the insurance companies, and therefore the work for obvious reasons is in the end likely to be more effectively and more economically done by men who are experts and specialists than by men who undertake it with no special training and with minds chiefly occupied by the demands of other lines of work.

I shall therefore assume that life insurance, and probably other types of insurance, including accident and sickness insurance, as represented by existing corporations, is not only well equipped to help in the solution of this problem, but is a part of the evolution of the times which has produced the problem itself, and is another illustration of the curious fact that in the processes of evolution a solution of a problem often appears at the same time the problem itself is evolved. For example, what might have happened in the enormous industrial activity of the United States and its necessary output of securities seeking purchasers if millions of people combining their small savings in the reserves of the great life insurance companies had not appeared upon the scene contemporaneously seeking securities in which to invest their money? The function of life insurance and of other types of insurance on the one hand, and the obligation of the employer of labor to his employees on the other, bear, it seem to me, an identical relation.

Life insurance is already effectively at work. While the employer of labor has only in the most limited way used the idea or appreciated its beneficence, progress has been made toward the solution of this problem. Eliminating industrial companies and including only those companies whose business is supposed to be confined to people of means, we find the average policy the country over is a little under $2,000. In other words, the mass of so-called regular insurance is held by people of small means. If now we add to these the millions who carry what is called "industrial" insurance, and the other millions who have so-called "fraternal" insurance, we have covered substantially the whole insurance field. We comprehend an interest whose accumulations surpass those of any other single line of human endeavor, except the accumulations of savings banks, and yet we have not gone outside of what may properly be called the laboring class. The energy of life insurance management, in other words, and the obligation which the laboring man feels toward his family, have in their development far outrun the sense of obligation of the employer. We have now reached the point when the employer is beginning to do his part—but as yet he has only made a beginning. That he will do more is certain; that he will do much is almost equally certain. That existing insurance institutions will be utilized is, I believe, a necessity.

Alloys Formed by the Compression of Metal Powders.

The ordinary method of preparing alloys consists in melting two or more metals together, and allowing the melt to crystallize after cooling. Can not the same alloys be obtained by compressing the component metals at ordinary temperatures in the shape of fine powders? Dr. W. Spring showed as far back as 1882 that under a pressure of 5,000 atmospheres the powders of the constituents of the Rose and Wood alloys will form conglomerates, the melting points of which nearly coincide with those of the alloys obtained by melting. In 1888 Hallock showed that by merely mixing at ordinary pressures the powders of the same constituents there is obtained a mixture

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melting at a lower temperature than the melting point of the most fusible component. By compressing zinc and copper powders, Spring obtained a conglomerate which was distinguished from brass only by its slightly darker color.

In spite of these partial results the problem had not so far been definitely solved. It remained in fact to be seen whether, by augmenting the speed of fusion of the mixed metal powders, pressure really favors the formation of those compounds which are characteristic of alloys obtained by melting. This question is answered by Prof. G. Tammann on the basis of recent experiments by G. Masing.

When submitting a mixture of filings of two metals forming neither a chemical compound nor mixed crystals (e. g., zinc and cadmium or copper and silver) to a pressure of 4,000 atmospheres, and heating the conglomerate thus obtained, the rising curve of temperatures is seen at a given point to slacken down, after reaching a temperature 10½ deg. C. higher than that at which the whole is found to melt. As far as its thermal properties and its structure are considered, this conglomerate is practically identical with alloys obtained by melting.

Again, by compressing under high pressure the powders of two metals forming a definite compound and capable of mixing in all proportions in a liquid condition, and by heating the conglomerate thus obtained, two stopping points are found in the curve of temperatures. The first of these points corresponds with the melting of a compound formed at the surface while the other corresponds with the formation of the alloy. This is the case, for instance, with mixtures of magnesium with zinc, lead, tin or bismuth. The conglomerate composed of magnesium and antimony has only a single stopping point situated at 300 deg. C. below the melting point of antimony. This corresponds with the formation of the compound Mg_3Sb_2.

The temperature then rises very rapidly in order to eventually fall down to the melting point of the alloy. The third case investigated by Masing relates to the conglomerate of two metals forming an uninterrupted series of mixed crystals, such as magnesium and cadmium on the one hand and lead and thallium on the other. When heating such conglomerates, only a single stopping point is observed corresponding to the melting point of the most fusible component. The form then assumed by the curve depends on the diffusion of the two components into one another.

The conglomerates obtained merely by compression do not contain any trace of mixed crystals. Microscopical examination thus only shows the existence of grains of copper and tin in recently prepared conglomerates. If, however, these mixtures be heated to 200 deg. C. (i. e., below the melting point of the tin) there are found between the grains of copper and tin, two layers corresponding to the compounds Cu_3Sn and CuSn respectively. If these conglomerates be heated during 20 hours to 400 deg., a layer of mixed crystals, corresponding to the formula Cu_4Sn, is found. This proves that compounds of these metals are permeable to their constituents.

The following conclusions are derived from these experiments:

The compression of two metals at ordinary temperatures will yield conglomerates containing only the pure metal, i. e., neither compounds nor mixed crystals as characteristic of alloys obtained by melting. Mere compression thus does not activate diffusion sufficiently to bring about combination or the formation of mixed crystals. If, however, heated metals (i. e., with increased speed of diffusion) are submitted to pressure, there is obtained not only a more coherent mass, but a portion of the metals is found to form compounds and mixed crystals, so as to produce a conglomerate which is very much like a real alloy.